

SYSTEMATICS OF *FREESIA* KLATT (IRIDACEAE)¹

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ABSTRACT

Freesia is a small genus of southern African Iridaceae subfamily Ixiodeae, here treated as comprising 11 species. The genus is divided into two sections based on tepal and bract morphology, section *Freesia* with dry bracts and cordate inner tepals, and section *Viridibractea* with green bracts. Species are concentrated in the southern Cape Province, in the Cape Floristic Region, but *F. andersoniae* occurs outside this area, in the Karoo, northern Cape and Orange Free State. Based on morphological and cytological grounds, *Freesia* is believed to be closely allied to *Anomatheca*, but other affinities are unknown. The genus was last revised in 1935 when 19 species were recognised, this number here substantially reduced. Taxonomic and horticultural history is reviewed in detail and several original chromosome counts are presented.

UITTREKSEL

DIE SISTEMATIEK VAN *FREESIA* KLATT (IRIDACEAE)

Freesia is 'n klein geslag van die Suider-Afrikaanse Iridaceae, subfamilie Ixiodeae, en word hier behandel as bestaande uit 11 soorte. Die genus word in twee seksies onderverdeel op grond van dek- en skutblaar morfologie; seksie *Freesia* met droë skutblare en hartvormige binne deklare en seksie *Viridibractea* met groen skutblare. Die soorte is gekonsentreer in die Suidelike Kaapprovinsie in die Kaapse Floristiese Streek, maar *F. andersoniae* kom buite die area voor; in die Karoo, Noord Kaap en Oranje-Vrystaat. Op morfologiese en sitologiese gronde word aanvaar dat *Freesia* naverwant is aan *Anomatheca* maar ander verwantskappe is onbekend. Die geslag is laas in 1935 hersien en 19 soorte is toe erken. Die getal word nou aansienlik verminder. Taksonomiese getal en tuinboukundige geskiedenis word in besonderhede bespreek en verskeie oorspronklike kromosoomtellings aangebied.

INTRODUCTION

It is now some 45 years since N. E. Brown's important revision of *Freesia* was published (Brown, 1935). This work was significant as the first revision of a genus of Iridaceae published since *Flora Capensis* (Baker, 1896) and *Flora of Tropical Africa* (Baker, 1898) and one of the first revisions of any African genus in a recognizably modern format in which detailed attention was paid to the early literature and especially to typification. In South Afri-

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ca, Brown's treatment provided the model for the excellent revisions and monographs of genera of Iridaceae by G. J. Lewis, published from 1941 onward, culminating in her study of *Gladiolus* published posthumously (Lewis *et al.*, 1972). In a broader sense, Brown's revision of *Freesia* formed a model for systematic studies in many other groups of southern African plants.

It has nevertheless become evident that Brown's revision, however valuable as a model, failed in two important respects. First, he failed to relate several so-called species known only in cultivation, either in Europe or South Africa, to wild plants, so that in recognizing "nineteen species native in South Africa" he substantially overestimated the true number of wild species. Second, too little herbarium material was known at the time to reasonably assess the degree of variation within species, so that Brown inevitably tended to oversplit species in a genus where differences even between distantly related species are now perceived to be very small.

In the present treatment, I recognize eleven species of *Freesia*, all known in the wild. Where I have been unable satisfactorily to relate species described from cultivated plants to wild forms, as in *F. gentilis* N.E. Br. and *F. picta* N.E. Br. I have taken the view that these are either horticultural forms or in the case of *F. xanthospila* and *F. herbertii* most probably poorly grown plants too abnormal to be correctly related to any wild species. I doubt that wild plants exist, as yet undiscovered, to which these species names can be applied.

TAXONOMIC HISTORY

Species of *Freesia* first found their way to Europe in the mid-seventeenth century, a time of rising interest in Cape plants. Burman, in 1768, described two, both from cultivation, placing one in *Gladiolus*, namely *G. corymbosus* and the other in *Ixia*, *I. caryophyllacea*. The placement in different genera reflected differences in the degree of zygomorphy, which were at that period regarded as generically significant.

A third species was named by Jacquin in 1795, also apparently in cultivation, this being *F. refracta*, which was assigned, like *F. corymbosa*, to *Gladiolus*. Another species was described by De Candolle from plants grown in Paris, *F. xanthospila*, and figured in Redouté's *Liliacées* in 1807, and also placed in *Gladiolus*. I am unable to relate this species to any wild plant, but suspect it may be a form of *F. caryophyllacea*, growing rather robustly owing to overwatering and low light intensity. In describing *Gladiolus sparrmannii* in 1814, based on specimens collected in South Africa before 1770 by Anders Sparрман, Thunberg added yet another species of *Freesia*. Thus by the first quarter of the nineteenth century, five named species of *Freesia*

were known, probably representing four native species. Three of these were in cultivation. There was no suggestion at this time that they constituted a distinct separable genus. Ker-Gawler (1804, 1827) who made a great contribution to the understanding of Iridaceae in segregating several genera from both *Ixia* and *Gladiolus*, as then understood (including *Hesperantha*, *Geissorhiza*, *Sparaxis*, *Anomatheca* and *Tritonia*) remained uncertain how to treat the group. He assigned *Gladiolus refractus* to *Tritonia*, *Ixia caryophyllacea* to incertae near *Sparaxis* and *G. xanthospilus* with doubt to *Tritonia*.

The early nineteenth century collectors, Ecklon, Zeyher and Drège, added only modestly to the knowledge of *Freesia*, and sent back to Europe collections of several species including *F. sparrmannii*, *F. refracta*, copious material of *F. corymbosa* (under the ms. name *Freesia odorata* Eckl.) and *F. leichtlinii* (named incorrectly *Tritonia securigera*). Burchell, also active in South Africa at this period, collected the common *F. corymbosa* and, interestingly, the first known specimens of *F. andersoniae*, a species only to be described over 100 years later.

It was only in 1866 that *Freesia* was described as a distinct genus, when Klatt published a description of *Freesia*, attributing the name to Ecklon. This name had not previously been published, but presumably derived directly from the manuscript name on Ecklon's collections of *F. corymbosa*. Some confusion has existed over the similar name *Freesea* Ecklon, an invalid genus, published without description (Ecklon, 1827). It was apparently intended to accommodate a group of species previously included in *Tritonia*, none of which actually belong in *Freesia* as now circumscribed. Klatt admitted three species to *Freesia*, *F. refracta*, *F. xanthospila*, and *F. odorata*, the latter an illegitimate and superfluous name since *Gladiolus sparrmannii* was cited as a synonym, though Klatt presumably intended *F. odorata* to apply to what is currently called *F. corymbosa*. A few years later, in 1874, Klatt described *Freesia leichtlinii* from plants in cultivation in Europe. The discovery of this species is discussed in detail in the systematic treatment. *Freesia leichtlinii* rapidly became a favoured horticultural subject, and when *F. alba* was introduced in England in 1878, the genus became even more important in horticulture. Its horticultural history, dealt with in the following chapter, begins at this period.

Freesia alba was formally described first by G. L. Meyer as *F. refracta* var. *alba*, and it was widely known by this name although as Gumbleton (1896) pointed out, *F. refracta* is a very different species and that *F. alba* was quite distinct. Curiously Baker (1892, 1896) treated *Freesia* as monotypic, under the name *F. refracta*, but he did recognize several varieties.

After 1900 the study of *Freesia* shifts from Europe to South Africa where Louisa Bolus, very active in the field, promoted the study of many groups of Cape plants including *Freesia*. In the short space of eight years, from 1926

—1934, she and her student, W. F. Barker described nine species, of which five are still recognized (Table 1). The nomenclature and typification of the genus was then in great confusion which resulted in Bolus describing as new some species well known in Europe, and in the misapplication of several names. Nevertheless she had, by 1933 progressed sufficiently in her understanding of *Freesia* to provide a key to 11 species (Bolus, 1933) she then recognized. This tentative treatment is remarkably similar to my own conclusions presented in this revision, and summarized in Table 1.

Bolus' studies were complemented by Brown (1933) who corrected some of the nomenclatural errors in Bolus' work. In 1935 Brown produced his monograph of *Freesia*, in effect combining Bolus' field knowledge with his understanding of the work done on the genus in the eighteenth and nineteenth century. As already mentioned, Brown's work suffered by his failure to relate several species known only from cultivated plants in Europe to wild counterparts and he thus overestimated the number of species. No

TABLE 1.

Species of *Freesia* arranged in systematic order with general distribution ranges and habitats.

Section <i>Viridibractea</i>	
<i>F. alba</i> (G. L. Meyer) Gumbleton	Southern Cape Coast, Plettenberg Bay to Hermanus—forest edges in sand.
<i>F. sparrmannii</i> (Thunb.) N.E.Br.	Langeberg foothills, forest edges.
<i>F. caryophyllacea</i> (Burm.f.) N.E.Br.	Caledon and Worcester east to Heidelberg—low bush on clay-shale soils.
<i>F. elimensis</i> L.Bol.	Heuningrug, S. of Bredasdorp—in fynbos on limestone.
<i>F. leichtlinii</i> Klatt	Southern Cape Coast, Agulhas to Mossel Bay—sandy soil in restioveld.
<i>F. fergusoniae</i> L.Bol.	Riversdale to Mossel Bay—low bush on heavy clay.
Section <i>Freesia</i>	
<i>F. refracta</i> (Jacq.) Klatt	Worcester district east in the southern Cape and Little Karoo—dry stony situations.
<i>F. corymbosa</i> (Burm. f.) N.E.Br.	Eastern Cape, Longkloof to East London—in low bush, sand or clay.
<i>F. occidentalis</i> L.Bol.	Bonteberg Karoo north to Calvinia—arid, stony habitats.
<i>F. speciosa</i> L.Bol.	Little Karoo—rare.
<i>F. andersoniae</i> L. Bol.	Upper Karoo, Northern Cape, Orange Free State—rocky hills.

further species of *Freesia* have been described since Brown's work but extensive collecting by G. J. Lewis, W. F. Barker and others, myself included, has filled many gaps in the ranges of species. The present study thus aims to fully document the distribution of species of *Freesia*, as well as to try and correct the shortcomings in Brown's monograph. This includes both the relating of species described in Europe from cultivated plants to wild species, and the emendation where necessary of the nomenclature.

RELATIONSHIPS

Freesia is a member of subfamily Ixiodeae and it has the typical several internode, basal rooting corm, and spicate inflorescence of the group. The significant taxonomic features of the genus are its conical corm, with netted tunics, several equitant leaves, stem flexed below the inflorescence, secund flowers, deeply forked style branches and rough surfaced capsule with large seeds. It agrees in all these characters with *Anomatheca* Ker-Gawler (Lewis, 1954; Goldblatt, 1971, 1972) a genus placed by Baker in *Flora Capensis* as a subgenus of *Lapeirousia*.

Freesia and *Anomatheca* are in fact very closely allied, and separable only on minor differences in the flower structure. The flower of all species of *Freesia* has perianth tube divided into two parts, a slender basal portion which widens abruptly into a much wider and longer cylindrical upper part. In some species the tube is slightly curved in the throat. In *Anomatheca* the perianth tube is either narrow and cylindrical throughout (*A. laxa*, *A. juncea*) or it widens gradually from the base (*A. grandiflora*, *A. viridis*, *A. fistulosa*). *Freesia* and *Anomatheca* are identical cytologically, both having a diploid number of $2n = 22$, and similar karyotype of small chromosomes (Goldblatt, 1972).

The affinities of *Freesia* and *Anomatheca* are more difficult to assess. The netted corm tunics and divided style branches suggest a relationship with *Watsonia* and its allies, which also have divided style branches, but rather different corm tunics. In appearance the corms of *Freesia* and *Anomatheca* seem to have more in common with *Tritonia*, *Ixia* and *Sparaxis* and their relationship may perhaps lie in this direction. If so, the divided style branches must be less significant taxonomically, and presumably arose independently in these two genera. Further information on the relationships of genera of Ixiodeae may be obtained by studies in chemotaxonomy and molecular biology, but morphology, anatomy and cytology are unlikely to provide new insights into this question.

GEOGRAPHY

Freesia is endemic in southern Africa and is restricted almost entirely to the Cape Province of South Africa. Species are concentrated along the south



FIG. 1.

Geographic distribution of *Freesia*, with numbers indicating concentration of species in degree squares of latitude and longitude.

coast and adjacent interior valleys (Fig. 1) and all but *F. andersoniae* occur in an area of significant winter rainfall. *F. occidentalis* is the only winter rainfall area species with a western rather than southern Cape distribution, and it occurs from the Bonteborg Karoo north to Calvinia along the very dry eastern foothills of the Cedarberg and Swartruggens, and in the Doorn-Tanqua River basin.

Freesia andersoniae, which has as wide a range as all the winter rainfall area species together, occurs in the upper Karoo, Northern Cape, western Orange Free State, and reputedly, although there are no records, in the south-western Transvaal and southern Botswana. This area is a semi-arid steppe and grassland which has predominantly summer rainfall, but also some winter precipitation in the south.

CYTOLOGY

The basic chromosome number in *Freesia* is $x = 11$. All but two of the 11 species have been counted at least once, and all reports so far are diploid, $2n = 22$. The first count in the genus was made by Taylor (1926) who counted $2n = 22$ in a cultivar which he referred to *F. refracta* as cv "Fischer." Brittingham (1934) also found $2n = 22$ in two cultivars "Rainbow Mixture" and "Purity" and $2n = 44$ in a third, "S. & W. Improved Purity," these cited as varieties of *F. refracta*. Further counts were published in Darlington & Jana-ki Amal (1945) by Lawrence for *F. "hybrida"*, $2n = 22, 33$ and 44 , and by LaCour for plants identified as *F. leichtlinii*, $2n = 22$. Further counts on cultivars were made by Mohr (1958) who reported nine named varieties to be polyploid, $2n = 44$ and another three diploid, $2n = 22$.

The first published counts for plants of wild origin were reported by myself (Goldblatt, 1971) for *F. refracta*, *F. alba* (as *F. muiirii*), *F. caryophyllacea* (as *F. elimensis*) and *F. cf. speciosa*. The latter count must be discounted as plants did not flower and had to be discarded before determination could be confirmed. The first counts on wild plants were however probably made by Zeilinga (1970—ms) who counted *F. parva*, *F. andersoniae* and *F. refracta*, all reported as $2n = 22$. Unfortunately there are no records of localities for any of the plants counted, nor were vouchers made, so determinations cannot be verified. In all probability *F. parva* is what in this treatment is called *F. caryophyllacea*. There is no reason to doubt the identity of the plants reported as *F. refracta* and *F. andersoniae*. Zeilinga's counts are listed here in Table 2, which includes reports for wild species.

Further counts of $2n = 22$ have been made for plants from horticultural sources and named *F. refracta* by Banerjee & Sharma (1971) and Banerji & Chaudhuri (1972). The identity of these plants is unknown, but they are almost certainly not *F. refracta*.

EVOLUTION

Species of *Freesia* are clearly closely related, but within the genus a few evolutionary trends are apparent. The near actinomorphic flowers of *F. alba* are probably primitive compared to the more zygomorphic and bilabiate flowers of other species. The green herbaceous bracts of section *Viridibractea* also appear to constitute a less specialized character than the dry, scarious bracts found in *F. refracta*, and the peculiar dry, brown-tipped bracts in the other members of section *Freesia* are presumably a further specialization. The characters of bract and flower are correlated, for species of section *Viridibractea* have in general less modified flowers than section *Freesia* in which the three allied species, *F. refracta*, *F. corymbosa* and

TABLE 2.

Chromosome numbers in wild species of *Freesia*. All localities in the Cape Province, South Africa. Original counts are in bold type. Counts for material of horticultural origin are not listed.

Species	Diploid Number	Collection Data/Reference
Section <i>Viridibractea</i>		
<i>F. caryophyllacea</i>	22	N. of Stanford, <i>Goldblatt 4846</i> (MO); Albertyn-Leeu R. road, Caledon distr. <i>Goldblatt 4836</i> (MO).
	22+1B	roadside N. of Napier, <i>Goldblatt 5598</i> (MO).
	22	Zeilinga (ms-1970, as <i>F. parva</i> , no collection data) <i>Goldblatt</i> (1971), as <i>F. elimensis</i> , Bredasdorp distr., <i>Goldblatt 379</i> (BOL).
<i>F. alba</i>	22	near Riviersonderend, <i>Goldblatt 3589</i> (MO).
	22	<i>Goldblatt</i> (1971), as <i>F. muiirii</i> , ex hort., <i>Goldblatt 145</i> (J).
	22+1B	Sandbaai, near Hermanus, <i>Goldblatt 5293</i> (MO).
<i>F. fergusoniae</i>	22	near Riversdale, <i>Goldblatt 3742</i> (MO), <i>Goldblatt 4893</i> (MO).
<i>F. leichtlinii</i>	22	Zoetmelksvlei, near Agulhas, <i>Goldblatt 4864</i> (MO).
<i>F. sparrmannii</i>	22	Grootvadersbos, near Heidelberg, <i>Goldblatt 4959</i> (MO).
Section <i>Freesia</i>		
<i>F. refracta</i>	22	near Stormsvlei, <i>Goldblatt 3717</i> (MO); Muiskraal-Barrydale road, <i>Goldblatt 3770</i> (MO).
	22	Zeilinga (ms-1970, no collection data); <i>Goldblatt</i> (1971), Worcester distr., <i>Goldblatt 143</i> (J).
<i>F. occidentalis</i>	22	Agter Cedarberg, E. of Matjesrivier, <i>Goldblatt 4069</i> (MO).
<i>F. corymbosa</i>	22	Upper Longkloof, <i>Goldblatt 4949</i> (MO). Klein R., N. of Hankey, <i>Goldblatt 4935</i> (MO).
<i>F. andersoniae</i>	22	Zeilinga (ms-1970, collection data unknown).

Uncounted species

F. elimensis (plants counted as *F. elimensis* have been redetermined as *F. caryophyllacea*).

F. speciosa (the count published for *F. cf. speciosa* (*Goldblatt*, 1971) must be disregarded as determination has not been confirmed).

F. occidentalis, have the most strongly bilabiate flowers, with, in addition, the inner tepals characteristically cordate lobed at the base.

On the above grounds it seems reasonable to regard section *Viridibractea* as the more primitive group, and within it the almost actinomorphic *F. alba* seems to be the least specialized species of all. Within the section, prostrate leaves, found in *F. caryophyllacea* and *F. fergusoniae*, are presumably derived, and these two are also unusual in their early blooming habit. Section *Freesia* comprises two groups, the small flowered *F. refracta* and its allies, mentioned above, with very specialized flowers, and *F. andersoniae* and *F. speciosa*, a related species pair with strikingly large flowers, structurally similar to but seemingly less specialized than those of the *F. refracta* group.

SPECIATION

The most significant factor in speciation in *Freesia* appears to be geographical isolation and this in fact seems to be the sole driving force for speciation in section *Freesia* while in section *Viridibractea* the situation is more complex. The three closely allied species of section *Freesia*, *F. corymbosa*, *F. refracta* and *F. occidentalis*, appear to have partitioned the dry interior valleys of the Cape Floristic Region and the adjacent western and southern Karoo (Fig. 2). In the west, *F. occidentalis* stretches from the Calvinia district south along the eastern Cedarberg, Swartuggens and Tanqua basin to Karooport and the Bonteberg Karoo. *F. refracta* extends from the adjacent Hex River Valley, and the Worcester Karoo east through the Little Karoo to the Oudtshoorn district, where the most easterly records are from the western valleys of the Kammanassie mountains. *F. corymbosa* continues this distribution, with its westernmost records in the foothills of the central and eastern Kammanassie mountains. This species extends through the Long Kloof as far east as the southern Transkei (Bawa Falls), being particularly common in the Port Elizabeth and Grahamstown areas. In spite of their adjacent ranges, these three species are quite distinct with no intermediates known. They probably evolved from a common ancestor the range of which became broken up during a drier period of the more recent past.

The remaining two species of the section, the large flowered *F. andersoniae* and *F. speciosa*, also appear to have had a common ancestry. *F. speciosa* is rare, and confined to a few sites in the western Little Karoo while *F. andersoniae*, more successful, is common in the upper Karoo and northern Cape, particularly at higher elevations, or where rainfall is more generous.

Speciation in section *Viridibractea* involves ecological and seasonal factors as well as geographical isolation (Fig. 3) and species are often adapted to contrasting habitats in the same general area. *F. alba* and *F. leichtlinii*

grow in sand along the southern Cape coasts, but *F. alba* is found mainly in stonier sites along forest margins, while *F. leichtlinii* grows in deep sand in restio veld. When growing near one another hybrids are found. *F. caryophyllacea* which extends from the Caledon and Worcester districts east to Heidelberg is restricted to clay and shale soils in low growing renosterbos type vegetation. Its habitat is thus distinct from the allied *F. alba* although they may grow nearby. Hybrids are suspected in intermediate situations. *F. elimensis* is confined to a limestone ridge near Bredasdorp. It appears to have originated through hybridization between *F. caryophyllacea* and *F. alba*, but today comprises a stable, uniform series of populations adapted to a limestone substrate.

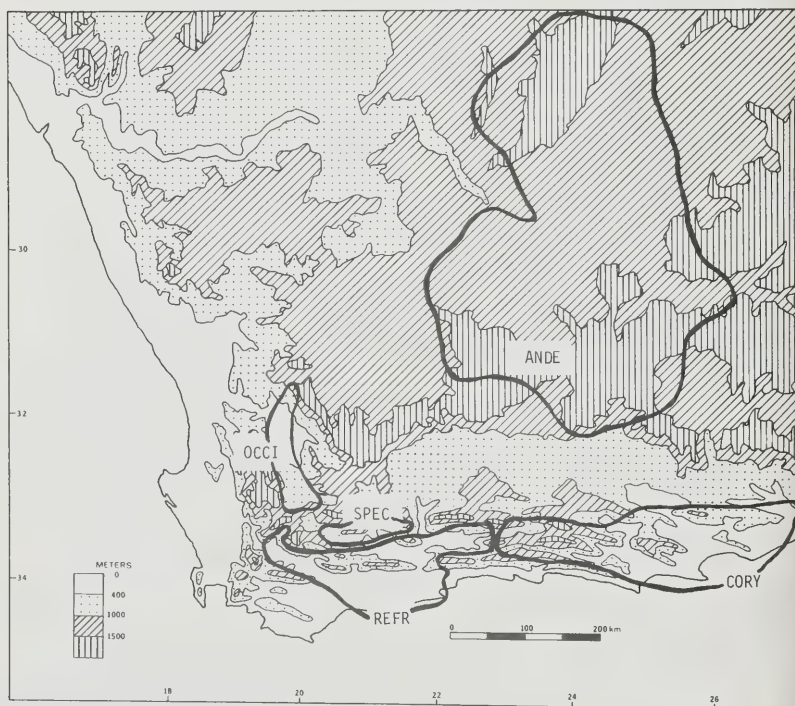


FIG. 2.
Distribution of species of *Freesia* section *Freesia*.

Geographic isolation is the most likely cause of speciation for *F. sparrmannii*, a species allied to *F. alba*, which is adapted to sandy soils along forest margins. It is restricted to a small area of the Langeberg foothills, well inland from the coastal forest where *F. alba* occurs. *F. caryophyllacea* and *F. fergusoniae* also appear to be species with a common origin, but appear to have differentiated in isolation. Both grow in heavy clay soils in renosterbosveld but *F. fergusoniae* is found in the southern Cape from the Riversdale area eastward and *F. caryophyllacea* occurs west of Riversdale. Separation of flowering time reinforces their isolation since *F. caryophyllacea* blooms from April to June and *F. fergusoniae* from late June to August.

HORTICULTURAL HISTORY

The horticultural history of *Freesia* is probably less well known than for most plants of comparable economic importance. The origin of the early cultivars has in fact been documented, though the literature is scattered.

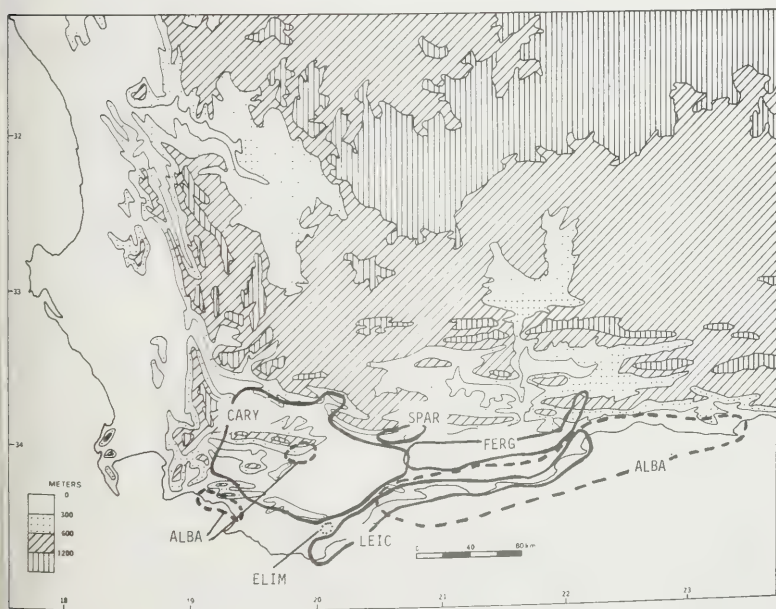


FIG. 3.
Distribution of species of *Freesia* section *Viridibractea*.

Much that has been written seems confusing and contradictory owing to the frequent misapplication of specific names and to the vastly different taxonomic treatments of the genus that have been in use over the last one hundred and fifty years. The history as outlined by Chittenden (1951) in the *Royal Horticultural Society Dictionary*, by Morgan (1929, 1930), Brown (1935), Zeilinga (1970–ms), Goemans (1980) and others, varies in detail and accuracy. Thus it seems useful for me to again relate the history here, giving original sources wherever possible.

Freesia was first grown in Europe, according to available records, in Holland in the mid-eighteenth century. The type collections of both *F. caryophyllacea* and *F. corymbosa* were grown in Holland by Burman, who described these two species in 1766. *Freesia refracta* was grown in Vienna later in the century and it was figured in 1795. These species, however, have little to do with the horticultural history of the genus as they were most likely not grown widely, nor were they used in the breeding experiments of the later nineteenth century. *Freesia caryophyllacea* and *F. corymbosa* probably did not persist in cultivation, but *F. refracta* either continued to be grown, perhaps only by plant collectors or was reintroduced from time to time, and it was sporadically figured (e.g. Redouté, *Liliacées*, tab. 419. 1813; Edwards, *Bot. Reg.* 2: tab. 135. 1816) in the nineteenth century. *Freesia corymbosa* was illustrated in Loddiges *Botanical Cabinet* (v. 19, tab. 1820) in 1832, as *F. odorata*, and was very likely reintroduced at about this period.

The history of the modern *Freesia*, however, really begins with the discovery by the horticulturist and plant collector, Max Leichtlin, of yellow-flowered plants in the Botanic Gardens at Padua (Jacob, 1909). He obtained some specimens, grew them himself, and distributed material widely. Klatt described this *Freesia* as *F. leichtlinii* in 1874, and it was figured repeatedly in horticultural journals in the following decade. It was evidently a popular ornamental pot plant, and available in the nursery trade. How *F. leichtlinii* ever reached Padua will probably remain a mystery, but the species was evidently discovered in South Africa in the 1820s by Ecklon and by Drège and either of these collectors may have been responsible for its introduction into Europe.

The next introduction of importance was the white-flowered, sweet-scented plant called *Freesia refracta* var. *alba* which appeared in the English nursery trade in 1878. This is now called *F. alba*, and is known today to be native to the southern Cape Province. Wild plants most closely matching the introduction occur in the Knysna area of the south coast. Shortly after its appearance in England, *F. alba* spread to the Continent and then to North America, and it was figured in numerous horticultural publications in the following twenty odd years, generally as *F. refracta* var. *alba*.

There is no record of how *Freesia alba* reached England and it was prob-

ably a casual introduction. MacOwan (1888) hints in a brief note that this species may have been cultivated at the Cape by Ecklon in the 1820s and then have been grown there continuously. He also suggests that the pure white form was the result of deliberate selection over a sixty year period. Brown (1935: 25) doubted this strongly, and I concur for there is no evidence supporting this statement. Indeed, the lack of specimens of *F. alba* collected either by Ecklon or others during the early to mid-nineteenth century suggests MacOwan was wrong.

Breeding of *Freesia* began immediately after *F. alba* came on the market. Corms of *F. alba* together with *F. leichtlinii* were acquired in 1878 by Rodolfo Ragionieri, head gardener of the Marquis Corsi-Salviati, who lived near Florence. The plants flowered in the same year (Ragionieri, 1884) and were crossed to produce the hybrids later named *Freesia* "*Giardino Corsi-Salviati*".

There are few records of *Freesia* breeding until the introduction in 1897 of the rose-pink-coloured form of *F. corymbosa*, which was named *F. armstrongii*. However, some sort of selective breeding apparently took place, as evidenced by the introduction by Suttons of *F. leichtlinii* "*major*" sometime before 1896 (Gumbleton, 1896) and a few other named forms. Morgan (1929, 1930) gives an indication of *Freesia* growing in North America and mentions Richard Bagg who had been hybridizing *Freesia* since 1885, although this work seems to have been of little importance.

The rose-pink-flowered *Freesia* was the plant which really provided the stimulus to *Freesia* breeding. Watson (1898) records that plants were sent to Kew by a Mr. Armstrong, of Port Elizabeth, who found them growing wild on a farm near Humansdorp. A half-dozen specimens bloomed at Kew in 1898, when the plant was named *F. armstrongii*. Stocks were increased yearly, and a good display was recorded in 1901 in *The Garden* 59: 374. The hybrid known as *F. X kewensis* dates from this time, and it was, according to records, an unintended cross between *F. leichtlinii* and *F. "armstrongii"* that arose at Kew Gardens.

The Dutch nursery firm of Van Tubergen soon acquired *Freesia armstrongii*, and this, crossed with *F. alba*, yielded the rose-coloured-hybrid marketed in 1905 as *F. "tubergenii."* Van Tubergen continued breeding with the species and hybrids then available (Hoog, 1909), and produced a range of tall *Freesias* with colours ranging from blue, mauve, shades of rose, yellow and white. The son of Rodolfo Ragionieri, Attilio, also acquired *F. armstrongii* and bred a strain called *F. "ragionieri"* (Grignani, 1907) by crossing it first with *F. alba* and *F. leichtlinii*, and continuing to breed the offsprings of these hybrids.

In this early history of *Freesia*, mention must also be made of the so-called Chapman *Freesias*, raised by F. Herbert Chapman. According to

Jacob (1909), Chapman crossed *F. alba* (*F. refracta alba*) with a plant called *F. aurea*, and then crossed the resulting F1 hybrids back to *F. alba* to produce a range of deep to pale yellow, tall Freesias, the finest form of which became known as *F. "chapmanii."* *Freesia aurea* was a name used in horticulture only, and is evidently a deep yellow flowered form of *F. corymbosa* (Brown, 1935) known botanically at this time as *F. odorata*. Michael Foster, who knew the Freesias in cultivation in England well (Foster, 1888), mentions an *F. aurea* being similar to *F. refracta*, but with rich bright yellow flowers and less scarious bracts. This is supported by observations by Gumbelton (1896) who describes *F. aurea* as deep golden, late blooming and very like *F. refracta* in other respects. *Freesia aurea* is thus a second form of *F. corymbosa* to play a role in the history of cultivated *Freesia*; the first being "*F. armstrongii*." It was also the fourth wild genome that entered the gene pool of horticultural stocks.

The subsequent history of *Freesia* breeding does not involve the wild species and is a complex story of the introduction of new varieties, changes in fashion and the resulting succession of named plants finding favour.

The transfer of the Ragionieri *Freesia* stocks to C. Bruggemann in southern France is recorded by Grignan (1907) but this strain was evidently lost during World War I (Morgan, 1929; Zeilinga, 1970 ms). Van Tubergen and several other European and American breeders continued to produce new varieties, and the first polyploid "Buttercup" made its appearance in 1911. Today the majority of registered cultivars is polyploid (Mohr, 1958; Zeilinga, 1970 ms), with diploid strains important mainly in areas where plants are grown (Sparnaaijet *et al.*, 1968) every season from seed. The story of *Freesia* breeding after 1920 has recently been described in some detail by Goemans (1980), a *Freesia* breeder whose knowledge of the genus in cultivation is unparalleled. *Freesia* breeding is continuing today and varieties including double flowered types are being produced that bear less and less resemblance to the humble wild species.

TAXONOMIC CHARACTERS

Rootstock—the root stock is a tunicate corm of several internodes, generally conic in shape, which ranges in size from fairly small, ca. 10 mm at widest diameter in species growing in sandy soil (*F. alba*, *F. leichtlinii*, *F. sparrmannii*) with rather fine whitish tunic fibres, to 15–25 mm at widest diameter with coarser, pale to almost brown tunic fibres in species of shaley or rocky sites.

Stems—the flowering stalk may be characteristically branched (*F. refracta*, *F. corymbosa*, *F. occidentalis*, *F. sparrmannii*, *F. leichtlinii*, *F. alba*) or characteristically simple (*F. elimensis*, *F. caryophyllacea*, *F. andersoniae*).

F. speciosa and *F. fergusoniae* most often have a single secondary branch, but well grown plants may be very branched. The character is in general very variable.

The stem is smooth in section *Freesia*, but bears minute papillae in section *Viridibractea*. The papillae are rather sparse and often only present towards the base, but are well developed in *F. elimensis* and *F. caryophyllacea*, where they are dense and can almost be called a pubescence.

Stems are prostrate at base in *F. fergusoniae*; often entirely prostrate in *F. caryophyllacea*, prostrate to inclined in *F. elimensis* and sometimes inclined in *F. alba* and *F. leichtlinii*. This character is somewhat variable, and shaded plants are usually erect, even in species which characteristically have prostrate stems.

Leaves—the several leaves are arranged in a fan and vary in shape, apex and orientation. In *F. fergusoniae* and eastern forms of *F. caryophyllacea*, they are prostrate (Figs 6, 8), short, comparatively broad, and obtuse at apex. The western and typical form of *F. caryophyllacea* has prostrate leaves with acute apices. Leaves are long, acute, and either inclined or erect in *F. alba*, *F. leichtlinii* and *F. elimensis* and generally erect in *F. sparrmannii*. In section *Freesia* narrow erect and acute leaves predominate, but *F. speciosa* and *F. occidentalis* have obtuse, somewhat broader leaves.

Bracts—As Bolus (1933) and Brown (1935) first pointed out there are two very different bract types in *Freesia*, the herbaceous type of section *Viridibractea* in which the margins only, are transparent, and the dry scarious, transparent bracts of section *Freesia*. Within section *Freesia*, the bracts vary to some extent both in size, and in presence of dark brown tips. The characteristically short bracts of *F. corymbosa* have conspicuous dark apices, while those of *F. occidentalis*, *F. speciosa*, and *F. andersoniae* have comparatively smaller dark tips. The bracts of *F. refracta* are pale green during development and only become transparent and dry as the flowers begin to fade.

The outer bracts are always larger and usually slightly shorter than the inner which they enclose. The apices of the inner bracts are forked for a short distance.

Flowers—The flowers vary from almost actinomorphic (*F. alba*) (Fig. 4 A) to weakly or strongly bilabiate (Fig. 4 B–G) with larger upper tepal and small lower tepals, but the stamens are always unilateral with contiguous anthers and stigma curved to lie above and behind them. The perianth tube of *Freesia*, which distinguishes the genus from its ally *Anomatheca*, is cylindrical and narrow at base, enlarging abruptly into a much wider, also more or less cylindrical upper part. The tube is straight, except at the junction of basal and upper parts, where it is curved in a few species of section *Viridibractea* (e.g., *F. sparrmannii*) and in section *Freesia*, where this is most pronounced in the very long tubed *F. speciosa*.

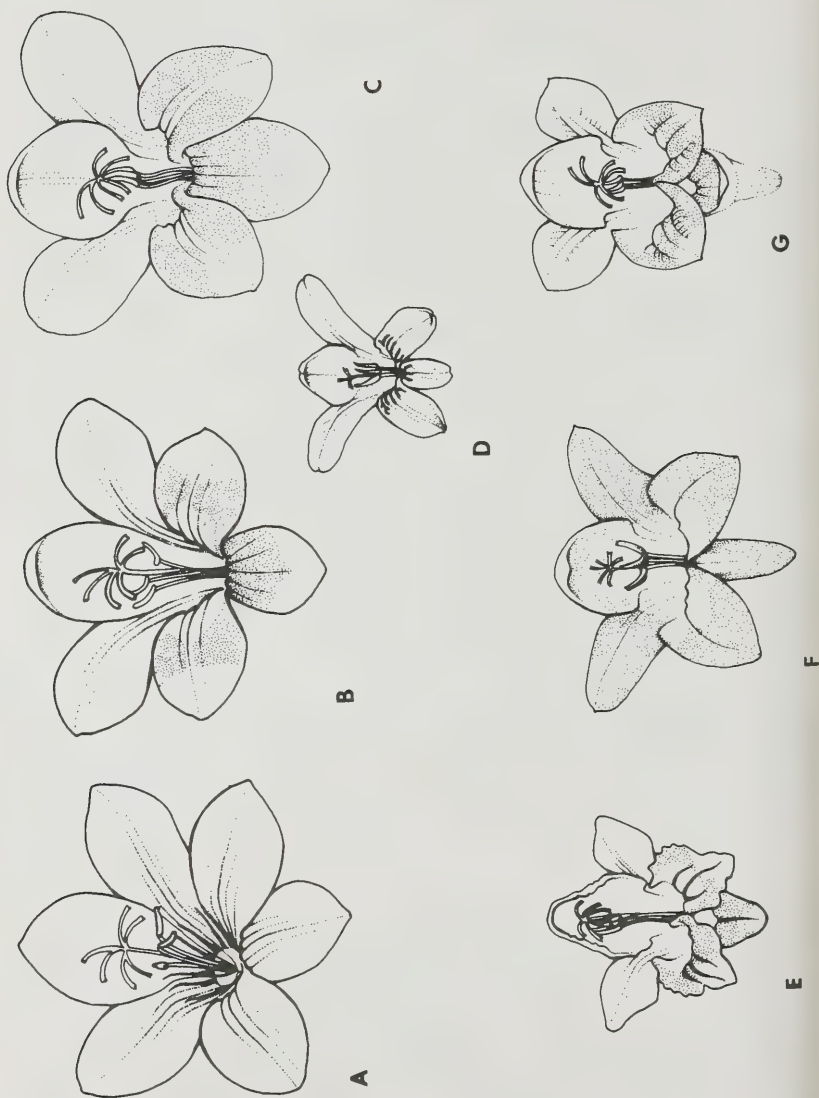


FIG. 4.

Flower types in *Freesia*: A. *F. alba*; B. *F. caryophyllacea*; C. *F. leichtlinii*; D. *F. sparrmannii*; E. *F. refracta*; F. *F. corymbosa*; G. *F. occidentalis* ($\times 1,5$).

The tepals range from almost equal and outspread in *F. alba* (Fig. 4 A) to unequal and with a large erect or hood-like upper tepal and smaller lower tepals. In section *Freesia* the inner tepals are cordate at base (Fig. 4 E-G) more strongly so in *F. refracta*, *F. occidentalis* and *F. corymbosa* than in the other two species of the section.

There are no characters of taxonomic significance in the androecium and gynoecium. Size of these characters in general follows flower size. Anther length is a useful guide for flower size and is used in keys and as a diagnostic character.

Fruits—The developing capsules of *Freesia* species are characteristic in being covered with papillae which give the surface a rough, almost rugose appearance (Figs 9, 10). This is less pronounced in dry material or ripe capsules but still evident.

SYSTEMATIC TREATMENT

***Freesia* Klatt**, *Linnaea* **34**: 672. 1866 nom. cons. contra *Lomenia* Pourret; Baker, *Handbk. Irid.* 167, 1892 et *Flora Cap.* **6**: 98, 1896; L. Bolus, *S. African Gard.* **23**: 111, 1933; Brown, *Jl S. Afr. Bot.* **1**: 1–31, 1935.

Tritonia Ker, *Konig. & Sims Ann. Bot.* **1**: 227–228, 1804, et *Irid. Gen.* 113, 1827, pro parte.

Plant small to medium 50–500 mm high, deciduous. *Corms* small to medium, 7–25 mm in diameter, with tunics of fine to medium netted fibres. *Stem* erect, inclined or prostrate entirely or only in lower part, simple or branched, smooth or sparsely to heavily papillate, flexed horizontally below inflorescence (unless entirely prostrate). *Leaves* several, equitant, lanceolate to ensiform, acute to obtuse, erect, inclined or prostrate, soft to firm textured. *Inflorescence* a horizontal spike; *bracts* firm and green with a hyaline margin or dry and scarious, pale throughout or tipped dark brown; outer larger, enclosing inner, these being forked at apex. *Flowers* zygomorphic, with unilateral stamens, either with $\pm$ equal, evenly disposed tepals (*F. alba*) or with unequal tepals and bilabiate flowers, usually strongly scented, and mostly shades of yellow and white, often purple-flushed, occasionally pink (forms of *F. corymbosa*); *tube* narrow, cylindrical at base, widening abruptly to larger cylindrical upper part; *tepals* subequal or upper larger and sometimes hooded, and lower three smallest, inner lobed and cordate at base in section *Viridibractea*. *Filaments* inserted at base of wide part of tepal tube, *anthers* oblong-linear unilateral, held opposite upper tepal. *Style* filiform, curving behind or over anthers, usually dividing near apex of anthers, branches slender, long, divided for half their length and arms

recurved. *Capsule* subglobose to oblong, three lobed, with rough, papillate surface, seeds several per locule, round and shiny. *Basic chromosome number* $x = 11$.

Type species: Freesia refracta (Jacq.) Klatt (lectotype).

Eleven species, all native in southern Africa, and all restricted to the winter rainfall area of the Cape Province except *F. andersoniae* which ranges throughout the Karoo, Northern Cape, western Orange Free State and extreme south-western Transvaal. Fig. 1.

SUBGENERIC CLASSIFICATION

Two sections are recognized as follows:

Section *Viridibractea* Goldbl., sect. nov.

Folia erecta, inclinata vel prostrata. *Caulis* parce vel dense papillosus. *Bracteae* virides, marginibus hyalinis. *Flores* subactinomorphes vel bilabiatai; *tepala* interiora basi non cordata.

Leaves erect, inclined or prostrate. *Stem* sparsely to heavily papillate. *Bracts* green with hyaline margin. *Flowers* with near actinomorphic tepals or bilabiate; *inner tepals* not cordate at base.

Type species: Freesia alba (G. L. Meyer) Gumbleton

Six species, restricted to the southern Cape Province, from Worcester and Houw Hoek in the west, south of the Langeberg-Outeniqua Mountain axis to Plettenberg Bay. Fig. 3.

Section *Freesia*

Leaves erect. *Stem* smooth throughout. *Bracts* pale greenish when young (*F. refracta*) or dry and membranous, usually dark brown-tipped. *Flowers* bilabiate, *inner tepals* cordate and weakly to strongly lobed at base.

Five species, ranging from Calvinia and Ceres in the west, to the border of the Transkei, and throughout the Karoo, Northern Cape to the western Free State and extreme south-western Transvaal. Fig. 2.

KEY TO *FREESIA*

1. Floral bracts membranous, transparent and dry (greenish in younger inflorescences, becoming papery from apex), with apices rust coloured in several species; inner (larger) tepals ovate or cordate and widest at base; stems smooth throughout.
2. Flowers normally 50–65 mm long.
 3. Leaves acute, tapering to apex, 5–10 mm wide; flowers cream to white with pale yellow markings; inner tepals 12–15 mm long and 8–9 mm wide; stamens 25–35 mm long ... 11. *F. andersoniae*

- 3'. Leaves obtuse (-subobtuse) apiculate, 10–20 mm wide; flowers yellow; inner tepals 13–18 mm long and 10–12 mm wide; stamens 32–40 mm long 10. *F. speciosa*
- 2'. Flowers normally 25–40 mm long.
 - 4. Bracts rust-tipped, 3–7 mm long; flowers usually white and yellow (occasionally pink).
 - 5. Leaves tapering to apex, acute, usually much shorter than the stem; inner bract (bracteole) usually about 2 mm wide near apex, with apical divisions obtuse and dark brown 9. *F. corymbosa*
 - 5'. Leaves obtuse (-subobtuse), two thirds to about as long as the stem; inner bracts about 1 mm wide near apex dividing into two narrow acute tips, barely tipped brown 8. *F. occidentalis*
 - 4'. Bracts uniformly membranous and pale 5–8(–10) long; flowers pale, or more often dull green to purple, with bright orange markings on lower tepals 7. *F. refracta*
- 1'. Floral bracts herbaceous, dark green, with a narrow hyaline margin; (not membranous even when aged); inner tepals oblong to broadly ovate and widest in lower third to midline, never cordate; stems either densely and minutely puberulent throughout, or at least sparsely puberulent-papillate towards the base.
 - 6. Lower part of perianth tube 12–15 mm long, about as long as upper part; upper tepal 5–7 mm wide; filaments 10–14 mm 2. *F. sparrmannii*
 - 6'. Lower part of perianth tube usually 6–8 mm long, if longer, only about half as long as upper part; upper tepal 9–15 mm wide or more; filaments (10–)13–20 mm.
 - 7. Leaves obtuse, appressed to ground
 - 8. Flowers yellow with orange markings on lower three tepals, stem prostrate in lower part or entirely; flowering in July and August, Riverdale district and east to Mossel Bay 6. *F. fergusoniae*
 - 8'. Flowers white or pale yellow with yellow markings in lower three tepals; stem usually entirely prostrate; flowering in May and June, Caledon, Worcester, Bredasdorp and Swellendam districts 3. *F. caryophyllacea*
 - 7'. Leaves acute, prostrate, inclined or erect.
 - 9. Flowers cream to pale yellow with broad yellow markings on lower three tepals; flowering late August–September, coastal between Agulhas and Mossel Bay in sand 5. *F. leichtlinii*
 - 9'. Flowers white to cream (often flushed lilac on reverse of tepals) with yellow marking on lower median or all three lower tepals or absent; flowering May–October, in various localities as below.
 - 10. Tepals subequal, nearly actinomorphic and all spreading; yellow marking on lower tepals absent or only on median tepal, coastal, between Hermanus and Plettenberg Bay 1. *F. alba*
 - 10'. Tepals unequal, upper largest, erect or hooded over anthers, lower tepals smaller, horizontal.

11. Lower part of perianth tube 8–10 mm long, widening abruptly; lower tepal marking usually only on median tepal; restricted to limestone hills in the Bredasdorp district 4. *F. elimensis*
 11'. Lower part of perianth tube 6–8 mm long, widening gradually; usually all three lower tepals with yellow markings; widespread, mainly on clay soils, Caledon and Worcester, east to the Swellendam district 3. *F. caryophyllacea*

Section 1. VIRIDIBRACTEA

1. *Freesia alba* (G. L. Meyer) Gumbleton, Gard. Chron. ser. 3, 19: 392. 1896. Fig. 5.

Freesia refracta var. *alba* G. L. Meyer, Zeit. Schweiz. Gartenbauv. 1: 37. Feb. 1881; Baker, Handbk. Irid. 99. 1892 et Fl. Cap. 6: 167. 1896. Type: illustration in Zeit. Schweiz. Gartenbauv. 1, tab. 3.

Freesia sparmanni var. *alba* (G. L. Meyer) Phill. & N.E.Br., Fl. Pl. S. Africa 1: tab. 11. 1921.

Freesia "alba" Foster, Gard. Chron. ser. 3, 3: 588. 1888, nom. inval. auct. non approb.

Freesia xanthospila (DC in Red.) Klatt sensu Klatt, Ergänz. 10. 1882 (Abh. Naturf. Ges. Halle 15: 360. 1882) et in Dur. & Schinz, Consp. Fl. Africae 5: 188. 1895, pro parte, excl. type.

Freesia refracta sensu L. Bolus, S. African Gard. 23: 111–112. 1933.

Freesia lactea Fenzl ex N.E.Br., Jl S. Afr. Bot. 1: 23. 1935. nom. inval. sin. descr. lat.

See EXCLUDED SPECIES for discussion of *Freesia picta* N.E.Br. & *F. gentilis* N.E.Br., both probably based on cultivated, horticultural forms taxonomically closest to *F. alba*.

Plants (50–)120–400 mm high. *Corm* conic, ca 10 mm in diameter at base, with fine, light brown, reticulate tunics. *Leaves* linear-ensiform, usually erect, occasionally procumbent, tapering, acute, usually the longest about as long as the stem. *Stem* usually erect, rarely inclined, minutely papillate at least towards base, usually branched. *Spike* (2–)3–6(–8) flowered; bracts herbaceous, with hyaline margin, 5–8 mm long, inner usually slightly shorter. *Flower* (25–)35–45(–60) mm long, with a very strong, sweet scent, white, sometimes with purple lines in the throat, and often a purple flush on the reverse of the tepals, fading darker purple, with or without a yellow mark on the lowermost tepal; *tube* (15–)20–40 mm long, narrow basal part 6–12 mm; *tepals* subequal, $\pm$ actinomorphic, outspread with upper tepal slightly larger and lower tepals slightly smaller, upper tepal 15–18 mm long, oblong to narrowly ovate, 8–12 mm wide. *Filaments* to 25 mm long; *anthers*

6–9 mm long. Style dividing at apex of anthers. Capsule ca 10 mm high and to 10 mm wide, rugulose. Chromosome number $2n = 22$.

Flowering time: late June–October.

Distribution: sandy soils, from Hermanus in the west to Plettenberg Bay; mainly along the coast, usually in light shade. Fig. 5.



FIG. 5.
Morphology and distribution of *Freesia alba*: habit - $\times \frac{1}{2}$; flower - $\times$ life-size.

Freesia alba has been known and widely cultivated in Europe since 1881. It was evidently brought to England from the Cape sometime before 1878, in which year it was offered for sale by the New Plant and Bulb Co. of Colchester, being advertised as *Freesia refracta* "alba." The name was first used in horticultural literature, and the earliest use I have been able to trace (name only) is in the *Gardener's Chronicle*, also in 1878 (Vol. 10: 23). It apparently was something of a sensation for in the following few years it appeared in almost every horticultural journal of note both in Europe and North America (see Brown, 1935, p. 23-24 for references). The first valid description as *F. refracta* var. *alba* appears to have been published by G. L. Meyer in the rare journal *Zeitschrift des Schweizerischen Gartenbauvereins*, Vol. 1, dated February 15, 1881. It was described by W. Robinson, almost simultaneously, in *The Garden* (Vol. 19: 199) dated February 19, 1881.

Botanists appear to have been satisfied with this treatment of the pure white, richly scented form of *Freesia alba* then in cultivation, as a variety of the very different, and horticulturally unattractive *F. refracta*. Baker (1892, 1896), the major authority of the day, accepted this taxonomy, and in fact always treated *Freesia* as monotypic, with several varietal forms. Klatt (1882, 1895), however, did recognize *F. alba* as distinct, associating it with *Gladiolus xanthospilus* DC in Redouté, a species of uncertain identity, but most likely a poorly grown plant of *F. caryophyllacea* (Burm.f.) N.E.Br. This treatment, however, has received no support.

Michael Foster (1888) also provided what appears to be a different treatment, for in an article in *The Garden* dealing with the genus *Freesia* Foster uses the name *Freesia alba*. He described the plant in detail, as well as other named *Freesia* "types." However, he quite clearly stated that he did not believe these types to represent true species. Today we would consider Foster's named types as cultivars, and thus *F. alba* Foster has no taxonomic validity. Finally, Gumbleton (1896) in a note in *Gardener's Chronicle* clearly and unambiguously pointed out that *F. refracta* and *F. refracta* var. *alba* were quite separate species. He described and illustrated the major points of difference and raised the variety to specific rank as *F. alba*.

Today, the casual way in which Gumbleton essentially made this new combination would not be valid, there being no reference to authorities or literature citations. However, there is no ambiguity about his intention to establish *F. alba* at specific rank, nor in the identity of the species with which he was dealing, thus his combination *F. alba* (G. L. Meyer) Gumbleton seems acceptable. Gumbleton's note and combination have been overlooked by the systematic community, possibly due to ignorance of his work or more likely because Foster's invalid *F. alba*, intended as a horticultural name, was generally regarded as the first valid combination.

In South Africa where *Freesia* was studied in some detail by H. M. L.

Bolus (1927, 1933), *F. alba* (without authorities) was recognized as a distinct species, but owing to confusion over nomenclature and typification the name was used for *F. caryophyllacea* while the true *F. alba* was known as *F. refracta*. Brown (1935) partly cleared the confusion when he correctly typified *F. refracta*, but he used the name *F. lactea* Fenzl ex Klatt for *F. alba*. Brown's use of the name *F. lactea*, attributed to Klatt, is a puzzle. He cited the *Zeitschrift des Schweizerischen Gartenbauvereins* Vol. 1: 37, in which *F. refracta* Klatt var. *alba* is described in an article signed by G. L. Meyer. Here Meyer noted in passing that his variety was the same as a plant he had seen in the Botanical Gardens in Vienna, and bearing the name *F. lactea* Fenzl. I have been unable to trace any other use of the names *F. lactea* Klatt or Fenzl and thus regard Brown's *F. lactea* Fenzl ex Klatt as a new species dating from 1935, as *F. lactea* Fenzl ex N.E.Br. It is, however, invalid, as no Latin description or diagnosis was provided, as required by the *International Code of Botanical Nomenclature*, established in that year.

Freesia alba is easily recognized when live by its open, upright flowers, with subequal spreading tepals. The flowers are almost actinomorphic, except that the stamens are unilateral and the lower tepal sometimes has a yellow marking. Plants are generally quite tall, and erect with upright narrow leaves, but occasionally the leaves and stem may be inclined towards the ground. Flowers may be either pure white or with a pale purple flush on the outer tepals, a colour which intensifies on fading or dying.

The white form of *Freesia alba*, which matches fairly closely the type of *F. refracta* var. *alba*, grows wild along the southern Cape coast between George and Plettenberg Bay, apparently in rocky situations on the edge of coastal forest. Specimens with either pure white or lightly purple-flushed flowers have been collected at several sites along this stretch of coast, but all plants have fairly long tubed flowers. Further west along the coast plants have a shorter tube and often heavier purple markings. The species extends as far west as Hermanus where I have collected pure white-flowered plants with a short perianth tube (*Goldblatt* 5293).

There are also records of *F. alba* from inland, notably along the foot of the Riviersonderend Mts., and near Albertinia. *Freesia alba* is confined to sandstone derived soils, and usually grows in very stony situations, always where I have seen it, at the edge of, or in open forest.

Freesia alba is regarded as the most generalized and least specialized species of the genus because of its nearly regular flowers, green bracts and erect leaves. Its closest relatives are *F. sparrmannii*, a tiny flowered species of the Langeberg foothills, with hooded upper tepals, and *F. caryophyllacea*, which has large bilabiate flowers and typically prostrate leaves and stems. Hybridization and introgression between *F. alba* and *F. caryophyllacea* is suspected in the Riviersonderend area where plants intermediate between

the two species occur. *Freesia elimensis*, a limestone endemic from the hills S. of Bredasdorp, is also intermediate in many respects between *F. alba* and *F. caryophyllacea* and a hybrid origin is suspected for this species.

The name *Freesia muirii* has been applied to *F. alba* in some herbaria, but the type collections, made by Muir, near Mossel Bay, appear to represent *F. leichtlinii* and hybrids between this yellow-flowered species and *F. alba*. As discussed under EXCLUDED SPECIES, *F. muirii* is a name best rejected.

Freesia alba is probably the most commonly cultivated of *Freesia* species and although its flowers do not compare in size and colour with the many cultivars now available, it has by far the finest scent of all species and cultivars. Most, if not all, horticultural forms have *F. alba* in their pedigree and many even today bear a strong resemblance to it in the form of the flower. The superb scent however has been diluted or sometimes lost in some cultivars through breeding for other characters.

S. AFRICA, CAPE—3322 (Oudtshoorn): Wilderness, rock crevices (-DC), *Compton* 16973 (NBG); Wilderness, *Cassidy s.n.* (NBG 11095).

—3419 (Caledon): Kwaiwater, Hermanus (-AC), *Williams* 251 (NBG); Sandbaai, Hermanus, coastal forest, *Goldblatt* 5293 (MO); Olifantskloof, N. of Riviersonderend (-BB), *Goldblatt* 3582 (MO); N. of Riviersonderend in shade near the river, *Goldblatt* 2053 (MO, NBG, S).

—3420 (Bredasdorp): Limestone hills 1.5 m W. of kloof on S. side of Potteberg (-BC), *Nordenstam* 1511 (S).

—3421 (Riversdale): 12 mi S. of Riversdale towards Blombos (-AA), *Lewis* 5629 (K, NBG); Zoetmelksfontein (-AB), *Muir* 383 (SAM); The Dunes, Riversdale distr. (-AC), *Ferguson s.n.* (BOL 18589, K); Stilbaai (-AD) *Rycroft* 3084 (NBG); Stilbaai-Blombos, *Thomas s.n.* (NBG 93847), *Wurts* 1556 (NBG); half mi E. of Albertinia (-BA), *Thomas s.n.* (NBG 93845); dwarf dune forest, The Fisheries (-BD), *Acocks* 21340 (K, M, PRE).

—3422 (Mossel Bay): Mossel Bay (-AA), *Rogers* 4416 (PRE), *Prior s.n.* (K), *Penther* 768 (K, PRE, Z); Goukamma, sandy soil (-BB), *Heineken* 119 (PRE), *Wurts* 2236 (NBG); Groenvlei-Wilderness, *Martin* 374 (BOL, NBG).

—3423 (Knysna): Brenton-on-Sea (-AA), *Denman* 31 (NBG); near Knysna, at Groot Rivier, coastal dunes, *Humbert* 10034 (P); Knysna Heads, rock ledges, *Keet* 1042 (GRA, P, PRE, SPE); Noetzi, *Middlemost s.n.* (NBG 61280, SAM 61716); stony ground, Plettenberg Bay (-AB), *Keet* 1021 (PRE, STE).

Without precise locality: Riversdale district, *Joubert s.n.* (STE 18575), *Muir* 4504, 4505 (K); Mossel Bay Division, *Muir* 4849 (K), 4849 B (K, PRE); Knysna-George, *Rodin* 1320 (BOL, K, MO, PRE); Knysna forests, *Laidley & Co.* 439 (G, K, Z); cult. Botanic Gardens, Cape Town, 2473 (PRE); *MacOwan* 2482 (K); hort. Reeves, Feb. 7, 1879 (K).

2. *Freesia sparrmannii* (Thunb.) N.E. Br., Fl. Pl. Africa 1: tab. 11. 1921; Brown, Jl S. Afr. Bot. 1: 19. 1935. Fig. 6.

Gladiolus sparrmannii Thunb., Kongl. Vetensk. Acad. Handl. 189–192.

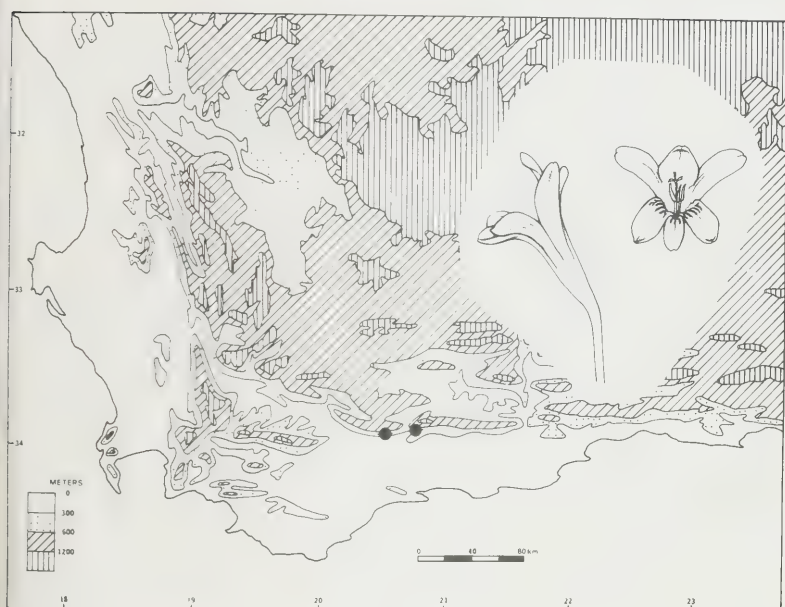


FIG. 6.

Distribution and floral morphology of *Freesia sparrmannii*: flower – × life-size.

1814. Type: S. Africa, Cape, exact locality unknown, *Sparrman s.n.* (S, lectotype and isotypes).

Ixia sparrmannii (Thunb.) Roem. & Schult., Mant. Syst. Veg. 1: 285. 1822.

Meristostigma sparrmannii (Thunb.) Steudel, Nomencl. Bot. 2: 130. 1840.

Plants 120–180 mm high. *Corm* conical, up to 11 mm in diameter, with tunics of fine, pale reticulate fibres. *Leaves* erect, linear-ensiform, acute, 100–160 mm long, the longest about as long as the stem apex. *Stem* usually straight, erect or inclined, 2–4 branched, sparsely papillate in lower half. *Spikes* horizontal, (3–)5–8 flowered; bracts (3–)4–7 mm long, herbaceous, with hyaline membranous margin; inner bract similar, often slightly shorter. *Flower* (30–)35–40 mm, not scented, white inside with yellow mark on lower tepal, and at apex of narrow part of tube, purple-flushed on reverse of upper

tepals and tube; *perianth tube* 20–27 mm, lower part 12–15 mm; *tepals* unequal, upper largest ca 11 mm long, 7 mm wide, obovate, slightly hooded, arching over anthers, upper laterals upright, ca 9 mm long, lower tepals to 9 mm long, 3–4 mm wide, flat. *Filaments* 10–14 mm long; *anthers* to 4.5 mm long. *Style* dividing 1–2 mm beyond anther apex. *Capsule* not known. *Chromosome number* $2n = 22$.

Flowering time: September.

Distribution: forest floor and margins, along the southern foothills of the Langeberg between Swellendam and Heidelberg. Fig. 6.

Freesia sparrmannii is a distinctive, low growing species, with a local distribution along forest margins and on the forest floor in the southern foothills of the Langeberg between Swellendam and Heidelberg. It appears to be closely related to *F. alba* but it is easily recognized because of the length of the narrow part of the perianth tube and generally small flowers with narrow tepals and perianth tube. Unlike *F. alba*, the flowers of *F. sparrmannii* are bilabiate, although this is not readily detected in dried material. The flowers are white inside and purple-flushed outside, with a small yellow mark in the lowermost tepal. On drying the purple colouring is intensified.

The species was collected in the 1770's by Anders Sparrman, and was subsequently described by Thunberg in 1814, who assigned it to *Gladiolus*. Klatt (1866) confused *G. sparrmannii* with *F. odorata* (i.e., *F. corymbosa*) and Baker (1896) included *F. sparrmannii* in *F. refracta* in *Flora Capensis*. It was only in 1921, when Phillips and Brown described *F. sparrmannii* var. *flava*, that this little known species regained recognition. Ironically, this variety, now *F. speciosa*, is no longer considered at all related to *F. sparrmannii*.

S. AFRICA, CAPE—3320 (Montagu): near Strawberry Hill Forest Reserve (Grootvadersbos) (-DD), *Esterhuysen* 10377 (BOL, K), *Goldblatt* 4959 (BR, C, E, K, MO, NBG, PRE, S, US, WAG), *Van der Merwe* s.n. (STE 10208).

—3420 (Bredasdorp): along the Buffeljags River (-BA), *Ecklon & Zeyher* 4027 (G, K, P).

Without precise locality: *Sparrman* s.n. (S).

3. ***Freesia caryophyllacea*** (Burm.f.) N.E.Br., Kew Bull. **1929**, 134 et Jl S. Afr. Bot. **1**: 12. 1935. Fig. 7.

Ixia caryophyllacea Burm.f., Fl. Cap. Prod. **1**. 1768. Type: S. Africa, Cape, original locality unknown (cult.) *Burman* s.n. (Herb. Burman, G. holotype).

Antholyza caryophyllacea (Burm.f.) Roem. & Schult., Syst. Veg. **1**: 448. 1817.

Anisanthus caryophyllaceus (Burm.f.) Klatt, Erganz. **10** (Abh. Naturf. Ges., Halle **15**: 344). 1882.



FIG. 7.

Morphology and distribution of *Freesia caryophyllacea*: habit - $\times \frac{1}{2}$; flowers - $\times$ life-size.

Freesia parva N.E.Br., Jl S. Afr. Bot. 1: 9. 1935. Type: S. Africa Cape, near Elim, Schlechter 7727 (K. lectotype, BOL, G, GRA, Z, isotypes).

Freesia alba Wats. sensu L. Bolus, S. African Gard. 23: 111-112. 1933.

Plants small, seldom reaching 100 mm high, usually $\pm$ prostrate. *Corm* conic, 10-15 mm in diameter, tunics medium in texture, pale to light brown. *Leaves* oblong to lanceolate, acute or obtuse, up to 100 mm long, prostrate to inclined or $\pm$ erect. *Stem* simple, rarely 1-branched, covered with a dense, minute puberulence, usually flexed close to ground level, and prostrate, occasionally (in shade) suberect or ascending. *Spike* usually prostrate or above ground level and horizontal or not flexed, 3-7 flowered; *bracts* green, herbaceous, usually with a hyaline margin, 4-8 mm long; inner bract similar, but usually smaller. *Flower* 30-45(-50) mm long, sweetly scented or odourless, white, often fading to brownish or purple, lined with purple within and

sometimes purple-flushed on reverse of tepals, marked yellow in midline of lower median tepal or all lower tepals; *tube* 20–25 mm, basal cylindrical part 6–8 mm; *tepals* unequal, 16–20 mm long, oblong to narrowly ovate, bilabiate, with upper tepal to 20 mm long, and 8–12 mm wide, hooded to erect and upper laterals reflexed outwards when fully open; lower tepals horizontal, smaller. *Filaments* 15 mm long; *anthers* 4–6 mm long. *Style* dividing at apex of anthers. *Capsule* 8–14 mm long, to 10 mm wide. *Chromosome number* $2n = 22$.

Flowering time: April–June.

Distribution: clay flats and slopes from the Caledon district extending east to Swellendam. Fig. 7.

Freesia caryophyllacea is a common although poorly known species of the Caledon, Bredasdorp and Swellendam districts where it typically grows on gravelly clay soils in renosterbosveld. It is remarkable in having a flowering period in the late autumn to early winter, a feature uncommon in the Iridaceae of the southern African winter rainfall area. Generally plants will come into bloom about a month after the first soaking rains of the season. If subsequent rainfall is scant, plants tend to be very dwarfed, and few flowered, but when well watered they may become robust with branched inflorescences held well above the ground.

The leaves of *F. caryophyllacea* are usually prostrate, less often ascending, but plants growing in the shade of bushes may develop fully erect leaves. Its stems are characteristically densely papillate-pubescent, a feature best developed in shorter stemmed individuals. The flowers are white, with yellow markings on the lowermost, or all three lower tepals, while the reverse of the tepals may be flushed with purple. In fading blooms or dried plants the purple flush is often accentuated, while the yellow markings may turn brown. When properly open the flowers are strongly zygomorphic. The upper tepal is largest, and is held erect or slightly forward and hooded over the anthers, while the upper laterals are reflexed outwards. The lower tepals form a nearly horizontal lip.

There is a confusing variation pattern in leaf shape and flower marking in this species. Populations in the west, centred around Caledon, have acute and often quite long leaves. This form matches the type specimen of *Freesia caryophyllacea*. The acute leafed plants usually have flowers with the yellow marking confined to the lowermost tepal only, and they also develop the darkest purple colouration on fading.

To the south-east, in the Bredasdorp area, and also to the north-east in the Robertson–Ashton area, plants have obtuse leaves, and flowers with yellow markings on all three lower tepals. Faded flowers often do not develop purple colouration. Such plants match exactly the type collection of *Freesia parva*.

There are intermediates in leaf shape, thus plants from Riviersonderend (*Stokoe s.n.*) and from the Stanford-Napier area (*Goldblatt 5598*) have sub-acute leaves. In such populations the younger, or smaller, plants often have fully obtuse leaves. Flower colouring varies inconsistently. Thus in some easterly populations such as at Mierkraal, south of Bredasdorp (*Goldblatt 5602*) flowers do develop purple with age, although surrounding populations do not.

The gradation in leaf shape from west to east, as well as the irregular pattern of variation in flower colouration, has convinced me that *Freesia parva* must be regarded as conspecific with *F. caryophyllacea*. Consequently *F. parva* is reduced to synonymy here.

Some of the variation in *Freesia caryophyllacea* may be due to gene flow between related species. *Freesia fergusoniae*, which has broad, obtuse, prostrate leaves and cream and orange flowers, is sympatric with *F. caryophyllacea* to the west of Heidelberg. The two have separate flowering times, *F. fergusoniae* typically blooming in July and August, but in some seasons both species may flower in late June—early July, which would make possible interspecific hybridization. If this occurred, subsequent introgression might explain the increasing obtuseness of leaves of *F. caryophyllacea* towards the east as well as the decrease in purple colouration in the flowers.

Hybridization probably also occurs between *Freesia caryophyllacea* and *F. alba* where these grow in proximity. Indeed, I believe *F. elimensis* to have had such a hybrid origin. Introgression between *F. caryophyllacea* X *alba* hybrids or between *F. caryophyllacea* X *elimensis* would explain the presence of deep purple flower colouring in *F. caryophyllacea* in areas where flowers usually lack purple, such as at Mierkraal (*Goldblatt 5602*).

Freesia caryophyllacea makes an inferior horticultural subject although it is of interest for its early blooming habit and the strong scent of some forms. Generally cultivated plants grow poorly. They either produce few flowers, if grown under good light conditions, or if grown in a greenhouse, or in poor lighting, become rank, leafy, and produce flowers which do not open properly or develop their normal form. A probable example of a greenhouse grown individual is the type illustration of *F. xanthospila*, figured in Redouté's *Liliacées*. This plant is probably *F. caryophyllacea* that has grown tall and leafy in a greenhouse in the dull, overcast winter of northern France (see EXCLUDED SPECIES) where it was grown.

S. AFRICA, CAPE—3319 (Worcester): Apiesklip, 11 m W. of Worcester on Olifantsberg (-CB), *Stayner s.n.* (NBG 77144); 7 km N. of Villiersdorp (-CC), *Goldblatt 5542* (K, MO, NBG, PRE); 30 km W. of Robertson, karroid bush (-DA), *Goldblatt 5632* (MO); Robertson (-DD), *Barker 7382* (NBG), *Schmidt 15* (PRE); 2 m from Robertson, *McMurtry s.n.* (NBG 92737).

—3320 (Montagu): 13.3 m E. of Bonnievale on N. bank of Breede River (-CC), *Perry 118* (NBG); Montagu common, *Hardy 252* (K).

—3419 (Caledon): Albertyn–Caledon, slopes above Leeu R. (-AA), *Goldblatt 4836* (MO); between Caledon and Baths (-AB), *Guthrie s.n.* (BOL 31510); near Caledon, *L. Bolus s.n.* (BOL 31511); Caledon, hill near Baths, *Marloth 14192* (PRE); road to Silverstream, S. Villiersdorp, *Goldblatt 1808* (MO); slope N. of Riviersonderend River, S. of Villiersdorp, *Goldblatt 4017* (MO); near Mission Station, 9 m from Caledon, *LeRoux 13* (STE); Hermanus district (-AC), *Taylor 3002* (NBG); Kleinmond road, near Caledon–Hermanus crossroads, *Goldblatt 3693A* (MO); Greyton–Riviersonderend (-B), *Middlemost 1684* (NBG); 10 m W. of Riviersonderend (BA), *Lewis 5911* (NBG); 5 m NW of Riviersonderend (-BB), *Heginbotham 14* (NBG); Riviersonderend, *Neethling s.n.* (BOL); 10 km N. of Stanford (-BC), *Goldblatt 4846* (MO); Caledon–Napier road, near Sandys Glen turnoff (-BD), *Goldblatt 5598* (MO); Fairfield, *Maytham-Kidd s.n.* (NBG 61286); Elim (-DA), *Schlechter 7727* (BOL, G, GRA, K, Z); Mierkraal flats, SW of Bredasdorp (-DB), *Goldblatt 5602* (MO).

—3420 (Bredasdorp): Wydgelegen (-AD), *Barker 4544* (NBG); Duiwenhoks River, Heidelberg (-BB), *Lewis 6133* (NBG); near Heidelberg, *Steyn 348* (NBG); between Swellendam and Heidelberg, *Goldblatt 1749* (MO, S, WAG); 18 km N. of Cape Infanta (-BC), *Goldblatt 5628* (MO); Bredasdorp (-CA), *Breach s.n.* (BOL 31514), *Goldblatt 5624* (MO); 8 km E. of Bredasdorp on Skipskop road, *Snijman 123* (NBG).

Without precise locality: Caledon Division, *Purcell s.n.* (SAM 66274); foot of Riviersonderend Mts., *Lewis 2321* (SAM); Riviersonderend Mts., *Hodge A146* (K); Swellendam Division, *Hurling & Neil s.n.* (BOL 20396); Ashton–Swellendam, *Barker 9268* (NBG).

4. *Freesia elimensis* L. Bolus, S. African Gard. **23**: 167–168. 1933; Brown. JI S. Afr. Bot. **1**: 11. 1935. Type: S. Africa, Cape, 8 miles from Bredasdorp on Elim road, *Barker & L. Bolus s.n.* (Nat. Bot. Gard. 697/33 in BOL, lectotype and isotype).

Plants 60–150 mm tall. *Corm* conic, ca 10 mm in diameter, tunics of fine pale fibres. *Leaves* erect or ascending (rarely prostrate), sometimes exceeding the flowers, linear-lanceolate, usually acute. *Stem* inclined, minutely papillate, unbranched. *Spike* usually 4–7 flowered; bracts green, with hyaline margin 7–9 mm long. *Flower* 35–45 mm long, scented, white, flushed light purple on reverse of tepals, and with a yellow-orange mark on midline of lower tepal; *tube* 25–35 mm long, basal narrow part 8–10 mm long, widening very abruptly; *tepals* unequal, upper largest, 18–22 mm long, 10–12 mm wide, oblong, upper laterals slightly narrower, lower tepals 16–18 mm long, 8–9 mm wide, oblong, horizontal. *Filaments* 18–22 mm long, *anthers* 5–6 mm long. *Style* dividing at apex of anthers. *Capsule* and seed unknown. *Chromosome number* $2n = 22$.

Flowering time: mid May–June.

Distribution: apparently restricted to the Heuningrug, a limestone ridge S. of Bredasdorp. Fig. 3.

Freesia elimensis is closely related to *F. caryophyllacea*, and the two are difficult to distinguish. Generally, *F. elimensis* is more robust, has larger flowers of a blue-white colour, with a yellow mark only on the lowermost tepal. The stem of *F. elimensis* is also inclined rather than prostrate. The most important difference between the two species is in the perianth tube which is longer, 25–35 mm in *F. elimensis* with the basal part 8–10 mm, which widens very abruptly into a very broad upper part. In contrast the tube of *F. caryophyllacea* is 20–25 mm long, with the basal part 6–8 mm long, and the transition more gradual into the upper part.

In many ways *Freesia elimensis* seems intermediate between the prostrate, bilabiate flowered *F. caryophyllacea* and the erect, near actinomorphic flowered *F. alba*, and it may have had a hybrid origin. As far as is known, it is restricted to rocky limestone slopes, where it grows in sandy soil (Bolus, 1933). It has only been collected on the Heuningrug, a limestone ridge south of Bredasdorp.

S. AFRICA. CAPE—3419 (Caledon): The Poort, S. Bredasdorp (DB), Barker 4569 (BOL, NGB); 8 m from Bredasdorp on Elim road, Barker & L. Bolus s.n. (Nat. Bot. Gard. 697/33 in BOL), Lewis 5966 (NGB); Heuningrug, north slope near Mierkraal, Goldblatt 5618 (MO).

5. *Freesia leichtlinii* Klatt, Regal Gartenflora **289**: tab: 808. 1894. Type: illustration in Gartenflora **289**: 808. **Fig. 8**.

Freesia xanthospila (DC in Red.) Klatt var. *leichtlinii* (Klatt) N.E.Br., JI S. Afr. Bot. **1**: 22. 1935.

Freesia muii N.E.Br., Gard. Chron. ser. 3, **92**: 467. 1932; in part (nom. rej.) (see EXCLUDED SPECIES).

Freesia middlemostii Barker, S. African Gard. **23**: 112. 1933. Type: S. Africa, Cape, Bredasdorp, *Middlemost* s.n. (Nat. Bot. Gard. 1551/31 in BOL, holotype).

Plants 80–200 mm (–500 mm under bushes) tall. *Corm* small, conic 8–10 mm in diameter with tunics of fine, pale reticulate fibres. *Leaves* erect, or inclined (rarely prostrate), usually slightly shorter than the stem apex, but occasionally exceeding the stem (in shade), linear-lanceolate, seldom exceeding 8 mm in width, tapering, acute. *Stem* ± erect, or inclined, sparsely papillate in lower part, often simple or 1–2 branched. *Spike* 2–8 flowered; *bracts* green, with hyaline margin, 4–7 mm long, inner narrower. *Flower* (25–)30–40 mm long, strongly scented, cream to pale yellow, with lower tepals dark yellow-orange, and upper tepals often brown-purple-flushed on reverse, bilabiate with lower tepals horizontal to down curved; *tube* (15–)20–25 cm long, basal narrow part (4–)6–8 mm, bent at apex of narrow part;

tepals unequal, upper largest 14–18 mm long and 13 mm wide, $\pm$ hooded, broadly elliptical, upper laterals ca 8 mm wide, lower laterals to 14–15 mm long, and 9–11 mm wide, ovate, margins curved upward. *Filaments* 10–14 mm long; *anthers* 6–7 mm long. *Style* dividing at apex of anthers. *Capsule* unknown. *Chromosome number* $2n = 22$.

Flowering time: August–September.

Distribution: southern Cape between the Mossel Bay district and Cape Agulhas, always near the coast, in sandy soil, with *Restionaceae*. Fig. 8.

Freesia leichtlinii is an attractive species with bilabiate pale yellow flowers, and bright yellow markings on the three lower tepals. The upper tepal



FIG. 8.

Morphology and distribution of *Freesia leichtlinii*: habit - $\times \frac{1}{2}$; flower - $\times$ life-size.

is distinctly hooded over the anthers and the upper laterals barely reflexed. The reverse of the tepals and tube are often lightly flushed with purple which intensifies in fading flowers or dried material. The plants are erect and generally rather slender, and often quite short. The leaves are usually upright but may be bent to one side, or rarely even prostrate. It grows in open areas among reed-like Restionaceae, e.g., *Chondropetalum* spp., in deep sand. The very small corms are often eaten by moles, that can destroy many plants in a population. Survival is ensured by the production of a small cormlet in many of the leaf axils. This character is known in other species of *Freesia*, but is best developed in *F. fergusoniae* and in *F. alba*, which also grows in sandy soils.

This species, first described by F. W. Klatt, has a curious history. Plants were apparently found by the horticulturist and plant collector Max Leichtlin in a neglected part of the Botanical Gardens in Padua in 1872. He took material back to England and after increasing stocks, he made plants available for cultivation. The plants described by Klatt thus came to him from Max Leichtlin's garden. *Freesia leichtlinii* remained in cultivation in Europe for some time, and was used in the production of new cultivars. The species was not known in South Africa at all, and when wild plants were discovered, first by Muir, and then by Middlemost, they were described as new, and in both cases named in honor of the collectors. There seems little doubt that *F. leichtlinii* is in fact the earliest name for the species. Although the cultivated plants from Leichtlin's garden seem more robust and broader leaved than wild plants, the flowers are identical in colour and form. The species is no longer in cultivation, presumably having been replaced by superior horticultural varieties.

It is quite unknown how *Freesia leichtlinii* came to be cultivated at Padua in Italy, but the species was apparently first collected in the 1820's in South Africa by Ecklon and by Drège. Ecklon's specimens came from the Bredasdorp district, and a sheet at Stockholm indicates the plants were sent by H. Joubert from Zoetendalvalley (sic). This collection bears the manuscript name *Sparaxis joubertii*. Drège's plants were evidently collected in the Tradouw ("Trado") area at 1 500–2 000 feet. There are no recent collections from this area, which is in the Langeberg Mts., and the locality may be mistaken. The early collections of this species were sometimes named *F. odorata* (= *F. corymbosa*) and it seems likely that *F. leichtlinii* was confused with this yellow flowered but otherwise very different species.

S. AFRICA, CAPE—3420 (Bredasdorp): The Poort, S. Bredasdorp (-CA). *Barker* 2691 (NBG), *Esterhuysen* 2184 (BOL), *Compton* 9011 (BOL, NBG); 8 mi. from Bredasdorp on Elim road, *Dymond s.n.* (Nat. Bot. Gard. 1858/33 in BOL); rietheuvels on farm Nacht Wacht, *Smith* 3045 (PRE); Agulhas (-CC), *Loubser* 2017 (NBG); 1 mi E. Cape Agulhas, *Nordenstam* 1431 (S); Agulhas-Struisbaai, *Salter*

4819 (BM, BOL, K); sandy flats E. Zoetendalsvlei, *Goldblatt 4864* (K, MO, NBG, PRE, WAG); "Zoetendalsvalley" *Ecklon s.n.* (S); S. Mungo Bay, Cape Agulhas, *Garside 4683* (K); sandy flats, Potteberg (-BC), *Esterhuysen 23226* (BOL). —3423 (Mossel Bay): dunes W. of Little Brak River, near railway bridge (-AA), *Thomas s.n.* (NBG 93846); Mossel Bay, *Prior s.n.* (K, Z).

Without precise locality: *Drège s.n.* "*Tritonia securigera*" (MO); "Trado, huge-lin", *Drège s.n.* (S); Bredasdorp distr. *Middlemost s.n.* (Nat. Bot. Gard. 609/31 in K), *Bishop Lavis s.n.* (BOL 21396); Mossel Bay Division, *Muir 4849* (K); hort. *Leichtlin* (1873) (K); hort. *Ware* (6/77) (K); herb. *Klatt* (S).

6. *Freesia fergusoniae* L. Bol., S. Afr. Gard. 17: 337. 1927. Type: S. Africa, Cape, near Riversdale, *Ferguson s.n.* (Nat. Bot. Gard. 423/27 in BOL, holotype); Brown, JI S. Afr. Bot. 1: 9. 1935. **Fig. 9.**



FIG. 9.

Morphology and distribution of *Freesia fergusoniae*: habit - $\times \frac{1}{2}$; flower and capsule - $\times$ life-size.

Plants (60-)100–200 mm high. *Corm* conic, to 15 mm in diameter, with pale medium to coarse reticulate tunics. *Leaves* prostrate, oblong, 100–150 mm long, outer, or all obtuse to subobtuse, acuminate, to 15 mm at widest. *Stem* prostrate entirely or only in lower part, and erect, to inclined in upper part, minutely scabrid-puberulent throughout or in lower part; usually 1–2 branched. *Spike* horizontal, 5–10 flowered, bracts herbaceous with hyaline margin, ca 6 mm long, inner similar but smaller. *Flower* 35–45 mm long, sweet-scented, cream-yellow, with dark yellow to orange markings on the lower three tepals, strongly-bilabiate; *tube* 22–26 mm long, slightly curved, narrow basal part 6–8 mm; *tepals* unequal, with upper largest, 12–14 mm long, oval, to 12 mm wide, erect to slightly hooded, outer whorl smallest, to 10 mm long and 8 mm wide, lower tepals $\pm$ horizontal, and surface of lower laterals naviculate. *Filaments* 13–16 mm long; *anthers* 5–7 mm long. *Style* dividing just above apex of anthers. *Capsule* 10–12 mm long, ovoid, to 9 mm wide, rugulose. *Chromosome number* $2n = 22$.

Flowering time: (late June–) July–August.

Distribution: clay flats in renosterbosveld; common between Heidelberg and Riversdale and extending east to Robinsons Pass. Fig. 9.

Freesia fergusoniae is one of the more attractive species of the genus. Well grown individuals can reach 200 mm in height and may bear one or two branches, each carrying several flowers. The flowers themselves are large, creamy-yellow with deep yellow or almost orange markings on all three lower tepals. In the populations I have seen plants have a typical *Freesia* scent, which though unmistakable is far weaker than in *F. alba*. In seasons with scant rainfall *F. fergusoniae* blooms earlier than usual, late June or July, rather than August, and plants are stunted, only 60–80 mm high and unbranched.

This species is usually easy to distinguish from the other members of the genus with green bracts, and is recognized by its fairly broad, obtuse and prostrate leaves, prostrate lower part of the stem, and the deep yellow markings on all three lower tepals of the bilabiate flowers. Its closest relative is the autumn–early winter blooming *F. caryophyllacea* which has prostrate stems as well as leaves. The eastern forms of *F. caryophyllacea* have obtuse leaves and cream-white flowers with yellow markings and are sometimes difficult to distinguish from dwarf forms of *F. fergusoniae*. In such cases flower colour is the most useful character for separation, *F. fergusoniae* having darker yellow tepal markings.

Freesia fergusoniae is a common geophyte on the clay hills and slopes around Riversdale in the southern Cape, where it grows in renosterbosveld. It extends west to Heidelberg, where it overlaps with *F. caryophyllacea*, and east towards Mossel Bay and Robinsons Pass. Plants bloom best in cleared

or burned areas, and not at all in dense bush. It was not known until the 1920's when it was sent by Mrs. Ferguson, a native of Riversdale, to Louisa Bolus who subsequently described it. *Freesia fergusoniae* has not been introduced into horticulture, but is grown at the National Botanic Gardens at Kirstenbosch. It makes a good garden plant, easy to grow, and prolific in flowering.

S. AFRICA, CAPE—3322 (Oudtshoorn): Moeras R., N. end of Robinsons Pass (-CC), *Hops* 24 (BOL).

—3420 (Bredasdorp): Swellendam-Heidelberg (-B), *Van Niekerk* 443 (BOL).

—3421 (Riversdale): Riversdale (-AA), *Muir* 5570 (PRE); *Ferguson s.n.* (BOL 18652); hill slopes above Riversdale, *Lewis* 6006 (NBG); 5 mi S. Riversdale, *Lewis* 6189 (NBG); roadside W. of Riversdale, *Goldblatt* 3742 (C, MO, PRE, S, WAG), 4893 (MO), 5191A (MO); 13 m E. Heidelberg, *Barker* 10638 (NBG); Soetmelksrivier (-AB), *Lewis* 6190 (NBG); 5 mi N. National road, towards Herbertsdale (-BB), *Thomas s.n.* (NBG 93844).

Without precise locality: Riversdale hills, *Muir* 4352, 4429, 4430 (K); Riversdale Division, *Bartlett s.n.* (BOL), *Ferguson s.n.* (BOL).

Section 2. FREESIA

7. *Freesia refracta* (Jacq.) Klatt, *Linnaea* **34**: 673. 1866; Baker, *Fl. Cap.* **6**: 98. 1896, excluding vars; Brown, *Jl S. Afr. Bot.* **1**: 17. 1935. **Fig. 10.**

Gladiolus refractus Jacq., *Ic. Pl. Rar.* **2**: tab. 241. 1795. Type; S. Africa, Cape, without locality, illustration in Jacq. *Ic. Pl. Rar.* **2**: tab. 241.

Tritonia refracta (Jacq.) Ker, König & Sims *Ann. Bot.* **1**: 228. 1804.

Gladiolus resupinatus Pers., *Syn* **1**: 45. 1805, nom superfl. pro *G. refractus* Jacq.

Freesia hurlingii L. Bolus, *S. African Gard.* **23**: 112. 1933. Type: S. Africa, Cape near Bonnievale, *Hurling & Neil s.n.* (Nat. Bot. Gard. 609/31 in BOL, lectotype, K, isotype).

Plants (80-)200-450 mm high. *Corm* conic, 15-20 mm in diameter, tunics pale, fine, reticulate. *Leaves* linear, tapering above, acute, 150-300 mm (or more) long, usually about two-thirds the length of the stem, but sometimes longer than the stem, 5-8(-10) mm wide. *Stem* smooth, erect, usually branched. *Spikes* horizontal to decumbent, 5-10(-12) flowered; *bracts* rather membranous, greenish in young stages, becoming dry and transparent, with brown veins, 5-8(-10) mm long, inner smaller. *Flowers* 25-35(-40) mm long, with a strong spicy scent, bilabiate, usually dull yellowish-brown or green to purple, occasionally pale yellow, with bright orange markings on lower tepals and purple veins in the throat; *tube* 16-24 mm, narrow basal part 5-9 mm; *tepals* unequal, inner cordate, upper largest, 11-14 mm long, 8-11 mm wide at base, hooded, upper laterals oblong, acute, 5-7 mm wide, 12-14 mm long, spreading, lower laterals hori-



FIG. 10.
Morphology and distribution of *Freesia refracta*: habit and corm - $\times \frac{1}{2}$; flowers and capsule - $\times$ life-size.

zontal to downcurved, (8-)11 mm long, 7-9 mm wide, margins curved upwards, obscuring the lowermost tepal. *Filaments* 10-14 mm long; anthers 5-6 mm long. *Style* branching at apex of anthers. *Capsule* to 10 mm long, ca 10 mm in diameter, three lobed, sometimes more or less smooth, or rugulose. *Chromosome number* $2n = 22$.

Flowering time: (late June-) July-September.

Distribution: clay soil, mainly arid stony places, or in limestone, in the southern Cape between Gouritz Mouth and Stormsvlei, extending west to Worcester and the Hex River Valley, and local in the Little Karoo. Fig. 10.

Freesia refracta was one of the early species of the genus to become known to botany, having been described in 1795 by Jacquin, as a *Gladiolus*. The nomenclatural history of this species gives a clear idea of the confusion that *Freesia* caused plant systematists of the day. Thus *F. refracta* was transferred to *Tritonia* by Ker (1804) then renamed in *Gladiolus* by Persoon, before being finally placed in his new genus *Freesia* by Klatt.

Although *Freesia refracta* is typified by an excellent painting in Jacquin's *Icones Plantarum Rariorum* which is true in colour and form, and shows clearly a medianly zygomorphic bilabiate flower, the species became confused with the horticulturally popular *F. alba* (then *F. refracta* var. *alba*). This typically pure white species has upright, almost actinomorphic flowers, with the characteristic *Freesia* scent. Thus references to *F. refracta* in botanical and horticultural literature throughout the later nineteenth century may be for *F. alba* and this is still true today of some horticultural literature. This was undoubtedly the reason for H. M. L. Bolus describing *F. hurlingii* in 1933. At this time she was still calling *F. alba*, *F. refracta* (Bolus, 1933), incidentally calling *F. caryophyllacea*, *F. alba*. The confusion was only partly clarified by Brown (1935) where he calls the pure white form of *F. alba*, *F. lactea* (a nomen nudum).

Freesia refracta, native to the Worcester and Little Karoo, and southern Cape, is closely related to *F. occidentalis*, which occurs to the north; and to *F. corymbosa* which ranges from the eastern end of the Little Karoo through the Long Kloof into the eastern Cape. All three species have similar bilabiate flowers with small naviculate lower tepals and dry bracts. Apart from its usually dull brownish or greenish flowers, and heavy spicy scent, *F. refracta* can be distinguished from these by its entirely pale, membranous bracts. Both *F. occidentalis* and *F. corymbosa* have dark brown-tipped bracts as well as typically white and clear yellow flowers. *Freesia refracta* grows on shaley soils, generally in dry situations and often under shrubs and low bushes. It also occurs on limestone.

A collection from the Warmwaterberg, Little Karoo (*Boucher 1569*) represents an interesting variant. While the flowers are typical, the leaves are unusually short and broad, being less than half the length of the stem and up to 15 mm wide. Another unusual form was found by Lewis (4432) near the Kammanassie dam, which also has short leaves, but the margins and major veins are thickened and hyaline, and the apices almost pungent.

S. AFRICA, CAPE—3319 (Worcester): Osplaats Station, N.E. De Doorns (-BC), *Mauve & Oliver 226* (STE, PRE); between Osplaats and Tunnel sidings, *Rogers 16739* (K, Z); Worcester, Karoo Garden (-CB), *Olivier 51* (STE), *Compton 20521* (NBG), *Barker 4663, 8024* (NBG), *Hall s.n.* (NBG 20,007, STE), *Stayner s.n.* (NBG 87597, STE); 1 m W. Breede R. bridge, towards Rawsonville, *Lewis 6048* (K, NBG); near Robertson (-DD), *Barker 5391* (K, NBG, STE); Robertson-McGregor, *Van Breda & Joubert 1964* (PRE); Vrolikheid, McGregor, *Jooste 179* (STE), *Van der Merwe 2981* (K, PRE); 34 km E. Worcester, *Nordenstam & Lundgren 1148* (MO, S). —3320 (Montagu): Ashton (-CC), *Van der Spuy s.n.* (BOL); Bonnievale, *Hurling & Neil s.n.* (Nat. Bot. Gard. 609/31 in BOL, K), (BOL 20186, K); sub Marloth 11939, 11946 (PRE); near Bonnievale, *Loubser 2118* (NBG); Scheepersrust, E. Montagu (-CD), *Barker 5428* (STE); Op-de-Tradouw, W. Barrydale, *Goldblatt 2841* (MO); E. foothills of Warmwaterberg (-DC), *Boucher 1569* (STE); near Barrydale, on Montagu road, *Van Niekerk 577* (BOL).

—3321 (Ladismith): 14.8 m S.S.E. Ladismith (-CB), *Acocks 20575* (K, PRE); Muiskraal—Brandrivier (-CC), *Goldblatt 3770* (MO); Calitzdorp (-DA), *Blackburn s.n.* (BOL).

—3322 (Oudtshoorn): DeRust (BC), *Van Niekerk 482* (BOL); near Oudtshoorn (-CA), *Loubser 999* (NBG); hills near Kammanassie Dam (-CB), *Lewis 4432* (SAM); farm Die Krans, DeRust distr., *Dahlstrand 2414* (PRE); Oudtshoorn—deRust, *Van Niekerk 342* (PRE); Ruitersbos, stony hilltop (-CC), *Van Niekerk 75* (BOL, PRE).

—3420 (Bredasdorp): roadside near Stormsvlei (-AA), *Goldblatt 3717* (C, BR, MO, S, WAG, US); Kathoek (-AD), *Acocks 22285* (PRE); 11 m S. Buffeljachtsrivier (-BA), *Acocks 24041* (K, PRE, STE); Suurbraak, *Mauve 4781* (PRE), *Acocks 16088* (BM, K, PRE, S); Duiwenhoks rivier, between Vermaaklikheid and Port Beaufort (-BD), *Lewis 5976* (NBG, STE).

—3421 (Riversdale): Riversdale distr. (-A), *Ferguson s.n.* (BOL 31506, BM, K); Riversdale (-AA), *Muir s.n.* (PRE); hills near Riversdale, *Muir 4432* (K); near Riversdale, *Bayliss 6565* (K, MO, WAG), 5851 (MO); limestone hills near Stilbaai (-AD), *Goldblatt 4152* (MO); The Fisheries (-BD), *Acocks 21356* (K, NBG, PRE); Gouritz R. mouth, *Mauve 4758* (K, STE); 8 m. from Gouritz Mouth, limestone hills, *Thomas s.n.* (NBG).

8. *Freesia occidentalis* L. Bolus, S. African Gard. **23**: 266. 1933; Brown, JI S. Afr. Bot. **1**: 10. 1935. Type: S. Africa, Cape, Nieuwefontein, N.W. of Bitterfontein, said to have been collected at Nieuwefontein, but probably from the Bonteberg, *Compton 4273* (Bol. lectotype: K, isotype).

Fig. 11.

Freesia framesii L. Bolus, S. African Gard. **24**: 245. 1934. Type: S. Africa, Cape, Calvinia distr. (cult. Cape Town), *Ross Frames s.n.* (BOL 21366).

Plants 90–250(–500) mm tall. *Corm* conic, 13–20 mm wide at base, tunics of brown, medium to coarse fibres. *Leaves* erect, to 150 mm long, usually about two-thirds the length of the stem, 6–13 mm wide, usually obtuse to subobtuse, apiculate, (rarely sub-acute). *Stem* erect, usually branched, smooth. *Spikes* horizontal to slightly decumbent, (3–)6–10 flowered; bracts dry, membranous, brown-veined and rust-tipped, 5–6 mm long, inner usually shorter. *Flowers* 30–38 mm long, bilabiate, cream-white (rarely pale mauve) with yellow lower tepals and lower tube, lightly sweet-scented or without scent; *tube* 18–25 mm long, basal part 6–11 mm long, strongly curved at apex of narrow part; *tepals* unequal, inner cordate, upper largest, hood-like, 8–11 mm long and 8.5–11 mm wide in lower third, upper laterals ovate, 8–10 mm long, 6–7 mm wide; lower laterals horizontal, with margins upcurved, ca 8 mm long, ca 7 mm wide. *Filaments* 13–15 mm long; *anthers* 4–5 mm. *Style* branching towards apex of anthers. *Capsule* 6 mm high, 8 mm wide, 3 lobed, surface smooth (evidently). *Chromosome number* $2n = 22$.

Flowering time: late July to September.

Distribution: arid flats and slopes from Pietermeintjies and the Bonteberg north along the eastern slopes of the Swartruggens and Cedarberg to Calvinia. Fig. 11.

Freesia occidentalis is a species characteristic of the very arid eastern foothills of the western Cape mountains, and of the summer dry western Karoo. It ranges from Pietermeintjies and Touwsrivier, through the Bonteberg Karoo, Karoopoort and southern Tanqua basin, along the eastern edge of the Cedarberg to the Calvinia district. It is probably fairly common within its range, but grows largely in inaccessible and remote areas, hence the few collections known.

The type collection, *Compton 4273*, is said to have come from Nieuwefontein, northwest of Bitterfontein in Namaqualand but this is unlikely. The species has never again been found in Namaqualand. Investigation of Compton's collecting notes reveals that in September of 1932, when *F. occidentalis* was collected, he gathered only one species in Namaqualand, not a *Freesia*, but also that he collected several species in the Bonteberg-Tweedside area several hundred kilometres away, and within the known range of the species. Most likely the collection came from this area, but later became confused with specimens from Namaqualand.

Freesia occidentalis is closely related to *F. refracta*, a species of the Little Karoo and Worcester area, and to *F. corymbosa* of the eastern Cape Longkloof. Differences between these species are discussed under *F. refrac-*



FIG. 11.

Morphology and distribution of *Freesia occidentalis*: habit - $\times \frac{1}{2}$; flowers - $\times$ life-size.

ta and *F. corymbosa*. *Freesia occidentalis* is one of the few species of the genus not known in cultivation. This is a pity since it grows easily, and is particularly floriferous. The flowers are brightly coloured, but comparatively small for *Freesia*.

Freesia framesii is reduced to synonymy here. The type of this species was grown in Cape Town from corms originally from the Calvinia area. It represents the northern form of *F. occidentalis*.

S. AFRICA, CAPE—3119 (Calvinia): Wilgebos farm, S.W. Calvinia (-DA), *Lewis* 5880 (K, NBG, STE), *Lavranos & Buller* 8859 (MO); Driefontein, S.W. of Calvinia, *Marloth* 10429, 12815 (PRE, STE); farm Kareeboomfontein, W. of Re-bunie, *Hanekom* 2417 (K, M, MO, PRE, WAG); Boskloof Pass, S. Calvinia, *Stayner s.n.* (NBG 87525).

—3219 (Wuppertal): 15 km E. Matjesrivier, Agter Cederberg (-AD), *Goldblatt* 4069 (K, MO, NBG, S, WAG); farm Zuurfontein, near Doorn River, *Owen s.n.* (NBG 99951).

—3319 (Worcester): Touws River—Ceres road (-B), *Thomas s.n.* (NBG 93843, STE); Karooport (-BA), *Herre s.n.* (BOL), *Compton* 5408 (BOL, NBG), *Dymond s.n.* (Nat. Bot. Gard. 1967/33 in BOL), *Barker* 1977 (NBG), *Hall* 120, 286 (NBG); flats W. of Inverdoorn (-BB), *Oliver* 3513 (STE); Bonteberg (-BD), *Compton* 3733 (BOL, NBG).

—3320 (Montagu): poort N. of Pienaarskloof (-AA), *Acocks* 23682 (PRE); Pietermeintjies (-AD), *Archer* 812 (BOL).

Without precise locality: Calvinia district, *Lavis s.n.* (BOL 31512); *Skaife s.n.* (BOL 21366).

Locality doubtful: Cape—3018 (Hondeklipbaai): Nieuwefontein, 45 m N.E. Bitterfontein, (-DA), *Compton* 4273 (BOL, K)—probably from the Touwsriver—Tweedside area.

9. *Freesia corymbosa* (Burm. f.) N.E.Br., Kew Bull. 1929: 132 et J! S. Afr. Bot. 1: 15. 1935.

Gladiolus corymbosus Burm. f., Fl. Cap. Prod. 2. 1768. Type: S. Africa, Cape, without precise locality (cultivated in Europe), *Burman s.n.* (Herb. Burman, G, holotype).

Tritonia odorata Lodd., Bot. Cab. 19, tab. 1820, 1832; nomen nudum.

Freesia odorata Ecklon ex Klatt, Linnaea 34: 672. 1866; nom. superfl. pro *Gladiolus sparrmannii* Thunb.

Freesia refracta var. *odorata* (Klatt) Baker, Handbk. Irid. 167. 1892; et Fl. Cap. 6: 99. 1896

Freesia armstrongii Watson, Gard. Chron, ser. 3, 25: 195. 1898; Brown, J! S. Afr. Bot. 1: 13. 1935. Type: S. Africa, Cape, Humansdorp distr. (cult. Kew), *Armstrong s.n.* (K).

Freesia metelerkampiae L. Bol., S. African Gard. 17: 337. 1929. Type: S. Africa, Cape, exact locality not known (cult. Cape Town) *Metelerkamp s.n.* (Nat. Bot. Gard. 1739/26 in BOL, holotype).

Freesia brevis N.E. Br., S. African Gard. 23: 263. 1933. Type: figure in S. African Gard. 17: 336. 1927 (an illustration of the type of *F. metelerkampiae* when live).

Freesia corymbosa (Burm. f.) N.E.Br. var. *aurea* N.E.Br., J! S. Afr. Bot. 1: 16. 1935 nom. inval. sin. descr. lat.

Plants (160-)250–500 mm high. *Corm* globose-conic, to 25 mm in diameter, tunics medium to coarse, light brown, reticulate. *Leaves* linear-

ensiform, 100–200 mm long, basal, acute. *Stem* erect, smooth, usually much exceeding the leaves, usually several-branched. *Spikes* (3-)6–10 flowered; bract 3–4(-6) mm long, usually dry-membranous, brown-veined, and rust-tipped (rarely apices transparent), inner bract similar, sometimes slightly longer, or $\pm$ equal, bi-apiculate. *Flower* 25–35 mm long, often without scent; typically pale yellow, with lower tepals bright yellow to orange, occasionally pink with yellow throat; *tube* ca 20 mm long, narrow lower part 4–10(-15) mm, upper part expanding rather abruptly, *tepals* unequal, upper largest, erect to somewhat hooded, to 12 mm long, and 10–12 mm wide, cordate, upper laterals ca 9 mm long, 5–6 mm wide, ovate-lanceolate, lower laterals ca 7 mm long, ca 7 mm wide, cordate, $\pm$ horizontal, margins curved upward and overlapping lower tepal. *Filaments* ca 15 mm long; *anthers* 4–6 mm long. *Style* dividing just beyond apex of anthers. *Capsule* 6–8 mm long, rugulose, sometimes appearing smooth when ripe. *Chromosome number* $2n = 22$.

Flowering time: as early as May, but generally late August–October, locally to late November.

Distribution: from the Uniondale and Willowmore districts eastwards to East London and Butterworth, most common in sandy soils in the Longkloof and Port Elizabeth-Albany districts. Fig. 12.

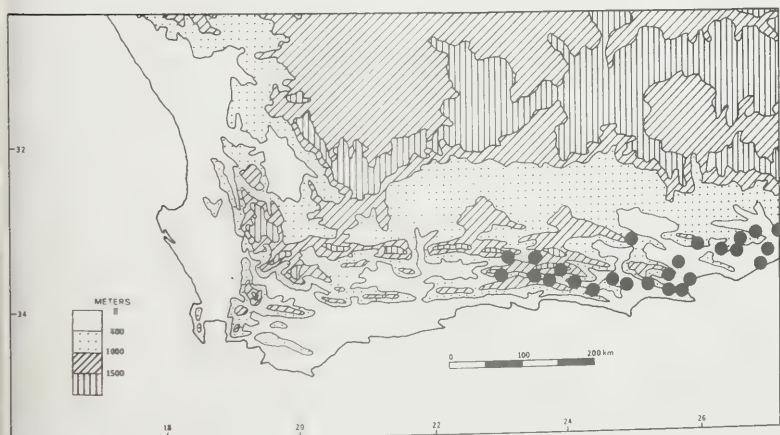


FIG. 12.

Distribution of *Freesia corymbosa* (one station, Bawa Falls, is outside the map area).

Freesia corymbosa, known until 1929 as *F. odorata*, was one of the first two species of *Freesia* known to science, having been described as *Gladiolus corymbosus* by Burman in 1768. The correct identity of Burman's plants remained unknown, until Brown examined the Burman herbarium in 1929 and realized that this name should be applied to plants then known as *F. odorata* Klatt. The species, sometimes also called *F. aurea* (a nomen nudum), was well known in Europe in the nineteenth century, but was frequently confused with the then poorly understood *F. refracta*. The variety *aurea* N.E.Br. refers to a particularly deep yellow flowered form of *F. corymbosa*, of horticultural importance at one time, and much used in early *Freesia* breeding.

Freesia corymbosa is closely related to both *F. occidentalis* and to *F. refracta*, and it is sometimes difficult to tell them apart. *Freesia refracta* has pale greenish to membranous bracts without the brown tip characteristic of *F. corymbosa*, as well as rather dull coloured flowers with a distinctive spicy scent. *Freesia occidentalis*, a species of the western margins of the Karoo and eastern slopes of the western Cape mountains, has bracts very like those of *F. corymbosa*, but generally smaller flowers and obtuse leaves in contrast to the typically tapering and acute leaves of both *F. corymbosa* and *F. refracta*. *Freesia corymbosa* is typically an eastern Cape species, but it extends west along the Longkloof to the Oudtshoorn district and east to East London and the border of the Transkei.

The rare pink-flowered *Freesia*, named *F. armstrongii* by Watson in 1898, is in my opinion no more than a colour form of *F. corymbosa*. The type collection originally came from near Hankey in the Gamtoos River valley and is uniformly pink except for the base of the tube which is yellow (see HORTICULTURAL HISTORY for details of its introduction to England). I have collected plants, Goldblatt 4935, matching the type in every respect and found them growing in deep red soil at the edge of dense bush. They had a faint but distinctly *Freesia*-like scent. This form differs from typical *F. corymbosa* mainly in the length of the basal part of the tube which is about 15 mm long. However, a similar tube length occurs in yellow flowered plants from Longmore Forest Reserve, not far to the east (e.g., Bayliss 7689, tube ca 10 mm) and from Addo and Enon (e.g., Bayliss s.n., tube ca 10 mm; Thode A2763, tube up to 17 mm) well to the north-east. These plants match *F. armstrongii* exactly except in colour.

South of Hankey, at Zuurbron and well to the west at Haarlem, pink-flowered forms much more like typical *F. corymbosa* occur. These plants have a shorter basal part of the tube (Fourcade 3331 & 5384, tube 4–6 mm long; Stayner s.n., tube ca 10 mm long and, in addition, yellow markings on the lower tepals). Plants collected "near Hankey," Andrews sub Galpin

4692, also have a short tube, and show signs of having had yellow markings on the lower tepals.

With this pattern of variation it is impossible to include pink-flowered plants in a separate species. Nor does it seem to be of value to separate longer tubed pink- and yellow-flowered plants together in a separate taxon given the degree of variation in quantitative features such as tube length found in all species of *Freesia*. Brown (1935:3) reports that this pink form of *F. corymbosa* was first collected by the English plant collector Bowie, and that a painting was made in 1826 of plants grown at Kew at this time.

Freesia meterlerkampiae L. Bol. is almost identical with collections made by Fourcade at Zuurbron, and probably comes from there. The type material, a cultivated specimen, is doubtfully assigned to the Robertson area. Brown (1935, p. 13) included it in *F. armstrongii*.

S. AFRICA, CAPE—3228 (Butterworth): Bawa Falls (-AC), *Taylor* 3633 (NBG).

—3322 (Oudtshoorn): W. end of Kransberg, upper Long Kloof (-DB), *Goldblatt* 4949 (BR, MO, WAG); Kammanassie, road to Laudina, *Oliver* 3596 (K, PRE, STE).

—3323 (Willowmore): Hills S. of Toorwater (-AC), *Oliver* 3658 (PRE, STE); Zuurberg, at Georgida (-AD), *Fourcade* 4626 (BOL, STE); Long Kloof, road to Bo Koega (-CB), *Rourke* 893 (NBG); near Haarlem, Long Kloof, *Stayner s.n.* (NBG 91316); near Misgund (-CD), *Compton* 7293 (NBG).

—3324 (Steytlerville): 6–1½ m E. Greystone (-BB), *Acocks* 23272 (PRE); Kareedow–Assegaaibosch (-CD), *Goldblatt* 2863 (MO); poort between Cambria and Patensie (-DA), *Thompson* 1888 (K, PRE, STE); Klein R., Hankey (-DD), *Long* 1349 (K, UPE); Hankey, *Paterson s.n.* (GRA); near Hankey, *Andrews s.n.* in Herb Galpin 4692 (K, PRE); 5.5 km N. Hankey, *Goldblatt* 5935 (K, MO, NBG, PRE, S); Zuurbron, *Fourcade* 3331 (BOL), 3978 (BOL, K), 5384 (PRE, STE); Oswald Meterlerkamps farm near Zuurbron, *Holland* 2213 (BOL).

—3325 (Port Elizabeth): Kommadagga (-BB), *Bayliss* 1569 (B); Enon (-BC), *Thode* A2762 (K, PRE); Addo bush, *Begley s.n.* (PRE 15775); Groendal, E. of Uitenhage (-CB), *Long* 1074 (GRA, K, PRE, UPE), *Schnarf* 1416 (PRE); Longmore Forestry Station (-CC), *Bayliss* 7689 (MO, NBG); Van Stadensberg, *Zeyher* 4026 (G, P, SAM); Uitenhage (-CD), *Loubser* 908 (NBG); Zwartkops, near sea (DC), *Theron* 1389 (BM, K, LD, PRE); Zwartkops, saline meadows, *Brock* 7 (GRA).

—3326 (Grahamstown): Grahamstown–Riebeeck East (-A), *Bayliss* 6748 (MO); Plutos Vale, Albany distr. (-BA), *Bayliss* 2333 (B, G, Z), 6755 (MO); 24 m E. Grahamstown, *Barker* 7013 (NBG); Breakfast Vlei, *Bokelman* 5 (NBG); near Grahamstown (-BC), *Burke s.n.* (K), *Rogers* 27576 (G, Z), *MacOwan* 90 (MO, SAM), *Atherstone s.n.* (GRA), *Guthrie* 3440 (NBG); brickfield W. Grahamstown, *Goldblatt* 2866 (MO); Grahamstown flats, *Galpin* 207 (K, PRE); between Blaauwkrans and Military Post, Bathurst distr. (-BD), *Burchell* 3711 (K); Bathurst (-DB), *Sim* 19892 (PRE); Bathurst distr., *Sidey* 2041 (S), 3827 (P, S).

—3327 (Pieddie): Line Drift-Pieddie (-AA), *Sim* 4083 (PRE), 4089 (GRA).

Without precise locality: *Sparman s.n.* (S); hills between Zwartkops and Sundays R., *Ecklon & Zeyher* 286 (BM, GRA, K, S, SAM, STE), *Pappe s.n.* (BM); Albany distr., *Zeyher s.n.* (K), *Prior s.n.* (K); between Kariaga and Bushmans River at Jagersdrift, Albany Distr., *Ecklon & Zeyher Irid.* 108 (LD, MO, P, PRE).

10. *Freesia speciosa* L. Bolus, S. African Gard. 19: 385. 1929; Brown, Jl S. Afr. Bot. 1: 10. 1935. Type: S. Africa, Cape, Bonnievale-Barrydale (cult. Whitehill), *Archer s.n.* (BOL 19027, holotype).

Freesia sparrmannii var. *flava* Phillips & N.E. Br., Fl. Pl. S. Africa 1: tab. 11. 1921. Types: S. Africa, Cape, Ladismith distr., (cult. Pretoria), *Shand s.n.* (PRE 15786, holotype).

Freesia flava (Phillips & N.E. Br.) N.A. Br., Jl S. Afr. Bot. 1: 27. 1935.

Plants (80–)120–200 mm high including flowers. *Corm* conic, to 20 mm in diameter, with medium to coarse, light brown, reticulate tunics. *Leaves* straight to falcate, obtuse (–subobtuse), apiculate, usually shorter than the stem, unusually broad, to 20 mm wide. *Stem* erect, usually simple, (or up to 4 branched in cultivated material), smooth. *Spike* 3–6 flowered; *bracts* membranous, greenish below in early stages, becoming dry, brown-tipped, 8–10 mm long, inner bract slightly smaller. *Flowers* large, 50–70 mm long, pale yellow (evidently odourless), lower tepals deep yellow; *tube* 35–50 mm long, lower portion 14–20 mm, curved at apex of lower part; *tepals* 13–18 mm long, outer larger, broadly ovate, upper hood-like, 10–12 mm wide, lower laterals naviculate. *Filaments* 25–32 mm long; *anthers* 7–10 mm. *Style* dividing at mid-anther level or well beyond anther apex. *Capsule* unknown. *Chromosome number* unknown.

Flowering time: mid-August–September.

Distribution: Little Karoo, apparently scattered and rare. Fig. 13.

Freesia speciosa is the largest flowered species in the genus. It is poorly known, only a handful of collections having been made, all in the Little Karoo. It is probably most closely related to *F. andersoniae* which is native to the upper Karoo and Northern Cape. *Freesia speciosa* typically has obtuse to subobtuse, and rather broad soft-textured leaves, and yellow flowers usually 60–70 mm long with the tube over 40 mm, and broad, ovate inner tepals 12–15 mm at widest. *Freesia andersoniae* in contrast has narrower, acute leaves of rather rough texture, and pale, usually cream flowers 50–60 mm long with the tube 36–44 mm, and ovate inner tepals about 85 mm wide.

This species was first described as variety *flava* of the then poorly understood *F. sparrmannii* (Phillips & Brown, 1921) and later Brown (1935) raised this to specific rank, making a point of the rather long style, which in the type plant, extended beyond the top of the tepals. Louisa Bolus had in the intervening period described *F. speciosa*, which Brown recognized as distinct and, to judge from their widely separate position in his revision, considered unrelated. With a greater range of specimens available to me, I

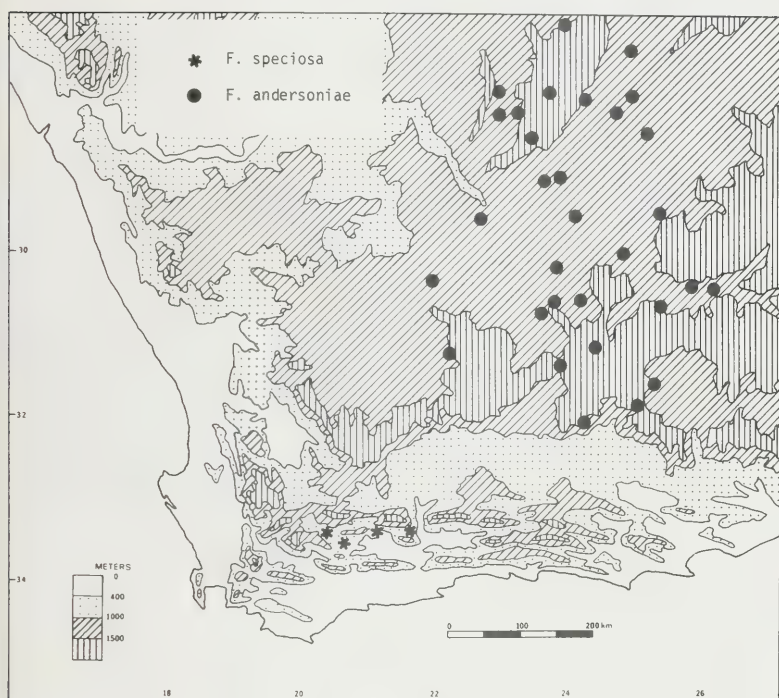


FIG. 13.

Distribution of *Freesia andersoniae* and *F. speciosa*.

have come to the conclusion that *F. speciosa* and *F. flava* are conspecific. The type specimens of the two species differ in minor features such as the length of the basal part of the perianth tube, degree of branching, and only the type specimen of *F. flava* has an exerted stigma. I cannot see any significance in this feature which is probably due rather to slightly abnormal growing conditions (the specimen was cultivated) than to a fundamental genetic difference.

Freesia speciosa was grown for a time in several Botanic Gardens in South Africa, and very successfully judging from the robust specimens made from the cultivated plants. It is no longer in their living collections, and is not known to be in cultivation elsewhere. With its very large yellow flowers, *F. speciosa* is undoubtedly a desirable garden subject.

S. AFRICA, CAPE—3320 (Montagu): Wittepoort. Laingsburg Div. (-AC) Barker 1976 (NBG); west end of Touwsberg (-DB), Wurts 1432 (NBG).

—3321 (Ladismith): near Calitzdorp (-DA), *Blackburn s.n.* (BOL 31500), (BOL 31501); *Herre s.n.* (BOL).

Without precise locality: Ladismith, *Krige s.n.* (Nat. Bot. Gard. 4671/14 in BOL); Ladismith district, *Shand s.n.* (PRE 15786); Bonnievale–Barrydale, *Archer s.n.* (BOL 19027, K).

11. ***Freesia andersoniae*** L. Bolus, S. African Gard. .8: 337. 1927; Brown, JI S. Afr. Bot. 1: 28. 1935. Types: S. Africa, Cape, Herbert Div., *Anderson 760* (BOL, lectotype); Syntype: near Hopetown (cult.), *Metelerkamp s.n.* (Nat. Bot. Gard. 1681/26 in BOL).

Plants 100–200 mm tall. *Corm* to 20 mm in diameter, conic, tunics light brown, fibres medium to coarse. *Leaves* several, linear-ensiform, acute, (50–)100–180 mm long, usually about as long as the stem. *Stem* erect, smooth, simple or 1–2 branched. *Spikes* horizontal 2–5 flowered; *bracts* dry-membranous, brown-veined, 7–10(–12) mm long, minutely rust-tipped; inner bract similar, usually ca 1 mm longer, acute or bi-apiculate. *Flower* sweet-scented, white to cream with yellow markings on the lower tepals and purple lines in the throat, 50–60 mm long; *tube* 36–44 mm long, curved towards apex of narrow part, narrow basal part 15–20 mm long; *tepals* unequal, inner 12–15 mm long, ovate, 8–9 mm wide, upper $\pm$ erect, outer 12–15 mm long, to 7 mm wide, outspread. *Filaments* 18–25 mm long; *anthers* 8–10 mm long. *Style* dividing near apex of anthers. *Capsule* and seeds not known. *Chromosome number* not known.

Flowering time: (late May–) August–early October.

Distribution: rocky koppies and flats in the upper Karoo from Carnarvon and Middelburg, north to the Kaap Plateau and Kuruman hills of the Northern Cape, including the western Orange Free State, and southwestern Transvaal. Fig. 13.

Freesia andersoniae is the most widespread species of the genus, having been recorded from sites scattered throughout the upper Karoo, Northern Cape and the western Orange Free State. I have been told that it occurs in the south-western Transvaal but I have seen no collection from there. The species is still poorly known, and much undercollected.

Surprisingly, although the first specimens of this species were collected by William Burchell in the early nineteenth century and again by Harry Bolus in 1867, *F. andersoniae* remained unnamed until its re-collection in the twentieth century. It was described as recently as 1927 by Louisa Bolus.

Freesia andersoniae is related to *F. speciosa* of the Little Karoo, the two having similar dry bracts and large flowers. The narrow and acute leaves, together with its large pale flower, make *F. andersoniae* easy to distinguish

from other species of the genus. It is not in cultivation, except perhaps in gardens within its range. There is a fine illustration of *F. andersoniae* in *Wild Flowers of the Northern Cape* by Jill Adams (1976).

S. AFRICA, CAPE—2723 (Kuruman): between Takun and ruins of Old Litakun (-BB), *Burchell* 2269 (K).

—2724 (Taung): 10 m E. of Taung (-D), *Fock s.n.* (KMG 8218).

—2822 (Glen Lyon): 6 m W. Lucas Dam (-BB), *Fock s.n.* (KMG 8209, PRE); Beeshoek, 5 m W. Postmasburg (-BD), *Leistner & Joynt* 2700 (G, K, KMG, M, PRE, S, Z).

—2823 (Griekwastad): municipal ground, Postmasburg (-AC), *Hanekom* 2429 (K, MO, PRE); hill NW of Danielskuil (-BA), *Leistner* 1518 (KMG); Jasper hills, Groenwater, Hay distr. (-CB), *Acoks* 2435 (PRE).

—2824 (Kimberley): Klipfontein, Kimberley distr. (-A), *Wilman* 825 (KMG); Warrenton (-BB), *Adams* 149 (GRA, KMG, PRE); Windsorton (-BC), *Elliot s.n.* (KMG 2694, TVL 19594).

—2922 (Prieska): Prieska (-DA), *Bryant* 324 (K, PRE), *Fuller* 219 (BOL, PRE).

—2923 (Douglas): Katlani, dolerite ridge (-BA), *Bruekner* 761 (KMG); St. Clair, Herbert Div. (-BB), *Orpen* 280 (SAM).

—2924 (Hopetown): near Hopetown (-CA), *Taylor* 883 (BOL).

—3021 (Vanwyksvlei): Vanwyksvlei (-BD), *Alston s.n.* (SAM 20966).

—3023 (Britstown): Karoo near Britstown (-DA), *Schlieben* 9159a (PRE); Britstown district (-D), *Van Niekerk s.n.* (STE 10689).

—3123 (Victoria West): Richmond (-BD), *L. Bolus s.n.* (BOL 31499).

—3124 (Hanover): Hanover (-AB), *Vimpany s.n.* (Nat. Bot. Gard. 1685/31 in BOL).

—3125 (Steynsburg): below Witkransnek, Middelburg distr. (-CA), *Acoks* 21416 (PRE).

—3224 (Graaff-Reinet): Sneeubergen (-AA), *H. Bolus* 1806 (GRA, K, S).

ORANGE FREE STATE—2825 (Boshof): Boshof Koppies, 15 m from Kimberley (-CA), *Bruekner* 885 (KMG).

—2924 (Hopetown): mountain slopes above Vanderkloof Dam (-D), *Van Maanen s.n.* (NBG 109220).

—2925 (Jagersfontein): Fauresmith, Karoo Reserve (-CB), *Potts s.n.* (PRE), *Smith* 385 (PRE), 487/2 (PRE), 437 (Z); Samekoms Plateau, Fauresmith, *Kies* 246 (PRE).

—3025 (Colesberg): Bethulie, koppies (-BD), *Feinauer s.n.* (MO, NBG, PRE); Inhoek farm, Donkerpoort (-CB), *Fourie s.n.* (PRE).

—3026 (Aliwal North): Eedendal, TDR Wildplaas (-AC), *Muller* 1013 (PRE).

Without precise locality: Langeberg, Hay Division, *Hunter* 20 (PRE); "Roodehoogte" (? = Rooihoogte 3124-DD) Middelburg, *Theron* 862 (PRE); Conway farm, Middelburg distr., *Gilfillan s.n.* in Herb Galpin 5577 (GRA, PRE); S. of Strydenburg, *Taylor* 854 (BOL); Herbert Division, *Anderson* 760 (BOL); Fraserburg—Carnarvon, *Wall s.n.* (LD).

EXCLUDED SPECIES

Freesia alba Foster, Gard. Chron. 5, 3: 588. 1888 nom. inval. non auct. approb.

In the article in which Foster discusses *F. alba*, he makes it quite clear that he does not regard *F. alba* as a species. He believed the plant to be a form or variant of *Freesia refracta*. Nomenclaturally the name is invalid.

F. angolensis (Baker) Klatt, in Dur. & Schinz, Consp. Fl. Afr. 5: 187. 1895. *Anomatheca angolensis* Baker, basionym. = *Lapeirousia schimperi* (Asch. & Klatt) Milne-Redh.

F. cruenta (Lindl.) Klatt, in Dur. & Schinz, Consp. Fl. Afr. 5: 187. 195. = *Anomatheca laxa* (Thunb.) Goldbl.

F. curvifolia Klatt, nom. nud., identity unknown.

F. gentilis N.E. Br., Jl S. Afr. Bot. 1: 20. 1935.

Type: South Africa, Cape, cultivated at the Botanical Gardens, Cape Town, from corms said to have been collected by G. Alston at Vanwyksvlei, in Bushmanland (SAM 20966, holotype).

The type specimens of *Freesia gentilis* resemble closely the cultivated *Freesia*, or perhaps a form of *F. alba*. The tall plants have well developed, herbaceous bracts and very long flowers. No such plants have ever been collected near Vanwyksvlei, and the only species of *Freesia* native in this area is the very different *F. andersoniae*, which has dry, papery, brown-tipped bracts. Brown (1935: 20) mentions that Alston also collected corms of *F. andersoniae* at Vanwyksvlei, and sent those to the Botanic Gardens at Cape Town. It seems probable that corms of cultivated *Freesias* somehow became confused with corms sent by Alston from Vanwyksvlei. It is best to reject *F. gentilis* from *Freesia* until such time as more information comes to light on its origins.

F. grandiflora (Bak.) Klatt, in Dur. & Schinz, Consp. Fl. Afr. 1: 187. 1895. = *Anomatheca grandiflora* Bak.

F. herbertii Klatt ex N.E. Br., Jl S. Afr. Bot. 1: 14. 1935.

Sparaxis herbertii Klatt, Linnaea 34: 674. 1866. nom. nud.

The type of this species was lost when part of the Berlin herbarium was destroyed in World War II. There is, however, a drawing of the type in the Bolus Herbarium, University of Cape Town. The single plant has two flowers, much distorted in pressing. The flowers appear to lack the slender basal part of the perianth tube, characteristic of *Freesia*, or this part may have been broken or folded under the flower. Nevertheless the plant is almost certainly a green bracted species of *Freesia*, perhaps *F. alba* or a cultivated form of *F. leichtlinii*. The species must be excluded as available authentic material is insufficient for determination. *Freesia herbertii* is certainly not a species as yet unknown in the wild.

F. juncea (L.f.) Klatt, in Dur. & Schinz, Consp. Fl. Afr. 5: 187. 1895. = *Anomatheca verrucosa* (Vogel in Trew) Goldbl.

F. muirii N.E. Br., Gard. Chron. ser. 3, 92: 467. 1932 et Jl Afr. Bot. 1: 19. 1935. Types: S. Africa, Cape, Mossel Bay Division, Muir 4849 (K), 4849A (K, PRE).

Freesia muirii, as circumscribed by N. E. Brown appears to include two separate species and their hybrids. The type collections, made by Muir from the same locality include a single sheet of *F. leichtlinii* (Muir 4849) and several sheets (Muir 4849A) of plants which seem to be hybrids between *F. leichtlinii* and *F. alba*, as well as some plants that appear to be *F. alba*. The information about the type population supports this conclusion, for the population evidently comprised plants with pure white (*F. alba*) flowers sometimes tinged on the reverse of the tepals with lilac, and plants with pale yellow (*F. leichtlinii*) flowers. As Brown's concept of *F. muirii* included the whole range of forms the species should be rejected as most probably based on a mixed collection of two species and their hybrids.

F. picta N.E. Br., Jl S. Afr. Bot. 1: 21. 1935.

Type: S. Africa, Cape, cultivated at the National Botanic Gardens, from corms said to have been collected at Beaufort West by (?Mrs.) Black s.n. (BOL, as Nat. Bot. Gard. 1538/13, holotype).

The two plants comprising the type collection have herbaceous bracts, and large long-tubed flowers and closely resemble the cultivated *Freesia*, or perhaps a robust form of *F. alba*. No such plants are known from the Beaufort West area, from which they are reported to have been collected. Perhaps an error in labelling occurred in cultivation, or corms of the cultivated *Freesia* were sent to the National Botanic Gardens in the mistaken belief that they were native in the district. The idea that some confusion is involved over *F. picta* is reinforced by the presence in BOL of nearly identical specimens, also cultivated at the National Botanic Gardens, reportedly from Mossel Bay, also collected by (?Mrs.) Black. The confusion surrounding the origin of *F. picta*, and the likelihood of its being of horticultural origin, makes its exclusion here justified.

F. rubella Bak., Bull. Herb. Boiss. ser. 2, 1: 868. 1901.

Type: Mozambique, Delagoa Bay, *Junod* 166 (Z).

Brown (1935: 29) transferred this species to *Watsonia*, as *W. rubella* (Bak.) N.E. Br. However, I have examined the type material, of which there are three sheets in the Zurich Herbarium, and there is no doubt this species is a synonym of *Anomatheca grandiflora* Bak.

F. xanthospila (DC. in Red.) Klatt, Linnaea 34: 672. 1865–66.

Gladiolus xanthospilus DC in Red., Liliacées 3: tab. 124. 1807.

Type: illustration in Red., Liliacées 3: tab. 124; possible type specimen in Herb. De Candolle (G).

Tritonia xanthospila (DC) Ker ex Spreng., Syst. Veg. 1: 154. 1825.

The problem in matching *Freesia xanthospila* with a wild species lies in

the fact that it was based on cultivated material. Both type illustration and the possible type material in the De Candolle collection at Geneva show typical characteristics of *Freesia* grown under conditions of low light and too much water. The leaves are overdeveloped, and the stem almost straight and not flexed at the base of the inflorescence. The flowers appear distinctly bilabiate with the lower three tepals smaller (especially in the De Candolle specimen) and with yellow markings on all three.

It seems likely to me that *Freesia xanthospila* belongs either to *F. alba* as Klatt (1895) believed, or to *F. caryophyllacea* which I think more probable due to the presence of tepal markings on all lower tepals and an apparent bilabiate condition. The type figure of *F. xanthospila* in fact resembles rather well taller, shade-grown plants of the eastern form of *F. caryophyllacea* except in the oversized leaves. N. E. Brown (1935) essentially dodged the issue of the identity of *F. xanthospila*, which he recognized, but did not relate it to a wild S. African plant. Interestingly, Brown treated *F. leichtlinii* as a variety of *F. xanthospila*. It was Brown's contention that *F. xanthospila* could not be conspecific with *F. caryophyllacea* because it lacked the dense minute pubescence found on the stem of this species. The stem of the De Candolle specimen is lightly pubescent, just as one would expect of a shade-grown, well-watered plant.

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